THE VETERINARY RECORD

FOUNDED BY WILLIAM HUNTING, F.R.C.V.S., 1888

No. 48. NOVEMBER 29, 1952 VOL. 64.

PAPERS PRESENTED TO CONGRESS, B.V.A., 1952

No. 5.—*VIBRIO FOETUS* INFECTION IN CATTLE*

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Mr. H. B. Allan, M.R.C.V.S., D.V.S.M., of Harrogate, was in the chair for this well-supported session in the Royal Hall of that town on the morning of Thursday, September 11th, 1952, when Mr. Lawson and Mr. MacKinnon, of Weybridge, presented their paper on *Vibrio foetus* of cattle. There was a well-sustained discussion, opened by Mr. G. S. Powley, M.R.C.V.S., of Wetherby, the Recording Secretary being Dr. K. C. Sellers, PH.D., B.SC., M.R.C.V.S., D.V.S.M., of Headingley, Leeds.

The CHAIRMAN: It is my pleasant duty, ladies and gentlemen, to introduce our speaker, Mr. J. R. Lawson. In fact, I do not think he needs introduction to us here. I hope and think most of you have read this paper and are vitally interested in the subject. I will ask Mr. Lawson to come forward and just elaborate somewhat on his paper. (Applause.)

Mr. Lawson's paper was as follows:—

Vibrionic abortion in cattle was first described in this country by M'Fadyean and Stockman (1913). In America, Smith (1919) found that 26 out of 109 foetuses examined were infected with *V. foetus* and he and his co-workers (1920) described further cases. Lerche (1927) reported on the bacteriological examination of material—foetuses, foetal membranes and uterine discharge—from 1,565 cases of abortion. *Br. abortus* infection was diagnosed in 56·6 per cent. of the cases and *V. foetus* in only 1·4 per cent. In one herd of 40 cows, however, *V. foetus* may have been responsible for four abortions and in another herd of 126 cows for six abortions. Snyman (1931) suggested that vibrionic abortion might be of considerable importance in South Africa when he found that 13 cows out of a herd of 160 aborted within a short period and he recovered the organism from the foetuses. In South Africa, also, Canham (1948) reported an outbreak of the disease in 1940. All the cattle were bred on the premises and no animal had been brought in for service. The bull was four years old and had never left the premises. The herd had been free from Brucellosis for over 10 years and no abortion had taken place during the preceding five years; in one year nine vibrionic abortions occurred but no further abortions were encountered during the succeeding five years. In this country, McEwen (1940) working in the S.E. counties found five cases of vibrionic abortion in three herds (out of a total of 247 foetuses from 45 herds in which he was carrying out vaccination work with *Br. abortus*) and concluded that *V. foetus* was not responsible for any serious outbreak of abortion. In the U.S.A. Plastridge, Williams and Petrie (1947) isolated *V. foetus* from 20 out of 72 foetuses and estimated that the incidence of abortion due to vibriosis varied from 4 to 20 per cent., whilst Rhoades and Hardenbrook (1947) recorded how the abortion rate in a vibrio-infected herd rose from 0·8 to 12·5 per cent. (17 cases) in three years. Wilson and McDiarmid (1950) when investigating the causes of abortion in S.19 vaccinated cattle in Berkshire found that *V. foetus* was present in 23 foetuses (30 per cent.) obtained from 20 herds.

The possibility that the bull might be implicated in the disease was first suggested by Plastridge and Williams (1943), who reported finding high agglutination titres in five out of six bulls originating in two out of seven herds using natural service, and later Plastridge, Williams and Petrie (1947) suggested that lowered conception rates might be found in infected herds. Sjollema, Stegenga and Terpstra (1949) found that many cows served by a particular bull failed to conceive although usually a few became pregnant at the first mating. Cows that failed to conceive at first service subsequently showed irregular oestral cycles of 23 to 36 days or longer. No abnormalities were noted in the semen or genital organs of the bull. They reported that of 49 animals inseminated artificially with semen from an infected bull only three conceived. Two of the three aborted and *V. foetus* was recovered from the foetuses. Of the remaining 46 cows, 44 were inseminated with semen from a healthy bull having a conception rate of 1·8 for 253 cows and it was necessary to inseminate each cow six or seven times before conception occurred. (The case bears a striking resemblance to that quoted by Rowson (1950) in which a bull in use at an A.I. centre in this country showed successful insemination of only 14 per cent.—no definite evidence was forthcoming, however, to indicate that *V. foetus* was implicated.) Sjollema and his co-workers isolated *V. foetus* from the semen of two bulls. A heifer served by one of the bulls developed catarrhal cervicitis and *V. foetus* was demonstrated in the vaginal mucus 15 days after service. The heifer did not conceive. Vibriosis was diagnosed as the cause of abortion in one cow served by the other bull and, further, the organisms were isolated in large numbers from the vaginal mucus of a heifer served by the same bull 30 days earlier. Herrick (1949) in the U.S.A. states that *V. foetus* causes abortion and could be carried by coitus from one female to another. The same worker isolated the organism from preputial washings from two bulls. In one case the bull was used in natural service and vibrios were recovered from aborted foetuses from the two cows served. The bull was subsequently used on a group of maiden heifers and one of them later aborting, *V. foetus* was isolated from the foetus. In the other instance, the bull was used in an A.I. centre and a cow inseminated with the semen subsequently aborted and *V. foetus* was recovered from the foetus. Stegenga (1950) produces evidence to support his contention that *V. foetus* is responsible for the enzootic sterility in the Netherlands and, in America, Webster and Thorp (1950) suggest that *V. foetus* infection may be venereal in character. In this country Wilson and McDiarmid (1950) could find no clear cut association

* Presented to the 70th annual meeting of the British Veterinary Association, at Harrogate, on September 11th, 1952.

of *V. foetus* infection *per se* with infertility. Deas (1950) describes the occurrence of an infectious infertility in Scotland.

Jepsen, Rasbech and Szabo (1951) suggest that *V. foetus* infertility is widespread in Denmark, and Szabo (1951) calculated that the condition might cause an annual loss to Danish farmers of £1,500,000. Rasbech (1951) states that the use of infected bulls in artificial insemination centres has been the means of spreading infection in Denmark, and Garm, Grini and Hoff (1951) suggest that this may be the case in Norway also. Adler, Rasbech and Szabo (1952) refer to an insemination centre in Denmark in which eight of 14 bulls were infected.

The literature contains few records of attempts to transmit infection to experimental cattle. M'Fadyean and Stockman (1913) attempted to infect seven pregnant cattle with uterine material from aborted ewes. Intravenous, oral and intravaginal routes were used, singly and in combination. One cow, given two injections intravenously, aborted and vibrios were recovered from the foetus and from the maternal cotyledons. Smith (1919) succeeded in infecting two out of four pregnant cows by injecting cultures into the jugular vein. Both animals gave birth to live calves but the placentas of both showed catarrhal lesions and *V. foetus* was found on microscopical examination. The same worker later (1923) succeeded in infecting five out of six cows intravenously with cultures of *V. foetus* (in two the cultures were also inoculated subcutaneously). Two cows aborted and four were killed at varying periods after the inoculation. Five of the six showed lesions in the foetal membranes and *V. foetus* was demonstrated in the membranes and exudate. Terpstra and Eisma (1951) report transmission experiments carried out on maiden heifers and also the artificial infection of a virgin bull by means of a culture of *V. foetus*.

That *V. foetus* might have some pathogenicity to man was suggested by Vinzent, Dumas and Picaud (1947) and by Vinzent, Delarue and Herbert (1950) and an annotation in the *Lancet* (1950) states that "Evidence is now accumulating that the infection can be transmitted to woman and that the abortifacient action is in many respects similar to that of animals."

At Weybridge our attention was first drawn to the organism in 1947. Following the introduction of S.19 in 1942 and its widespread use throughout the country during the subsequent years, we had to investigate the complaints made regarding its use in the field. These complaints fell into two main categories, *viz.*: (*a*) abortions in vaccinated animals and (*b*) the alleged association between vaccination and infertility. In investigating the complaints in the former category the primary object was to try to ascertain whether or not *Br. abortus* was implicated and with the passing of time it became increasingly evident that, in many cases, factors other than *Br. abortus* were involved. Limitations of time and staff, however, did not allow further and more detailed examinations to be made. Where complaints in the second category were concerned, our work with S.19 in the field did not support the belief held by many stock-owners, and by some of the members of our profession, that the use of the vaccine was concerned in the production of infertility in the vaccinated animals; but in many of the complaints investigated, in which the commencement of vaccination seemingly coincided with an outbreak of infertility, it was difficult to offer satisfactory explanations. During 1947, however, three such cases were investigated within a short space of time and, when later abortions occurred in two of the herds involved and *V. foetus* was isolated from the foetuses, we wondered whether the presence of this organism might be of significance, particularly in view of the similarity of the infertile condition present in the herds with many of the cases met with earlier.

A more detailed examination of the materials forwarded for diagnosis was commenced and a considerable amount of work done in attempts to improve our methods of isolation. Since then evidence has steadily accumulated to indicate that *V. foetus* infection is widespread throughout the country and to suggest that the organism has a greater pathogenicity than was previously recognised, not only as a cause of abortion, but also as a cause of bovine infertility. Later, the opportunity presented itself of comparing notes with the Dutch workers interested in the same problems and the contacts proved of great value.

Laboratory Work

Technique.—Routine examination of all foetuses is carried out as follows. Portions of (A) lung and (B) spleen are ground up with sterile sand and saline. Ground up material from (A) and (B) and also material obtained by pipette from (C) the first stomach and (D) the abomasum (pyloric end) is sown on (1) glycerine-dextrose dye plates (containing malachite green 1:500,000 and gentian violet 1:250,000) for the isolation of *Br. abortus*; (2) 10 per cent. ox-blood agar plates (1·8 per cent. Davis powdered agar) which have been adjusted to *p*H 7·8 to 7·6; and (3) similar ox-blood agar slopes to which is added 1 to 2 c.c. defibrinated ox-blood after inoculation. Duplicate plates and slopes are sown from each organ, one set being incubated aerobically and the other in 10 per cent. CO_2. From the pooled materials from (A), (B), (C) and (D) guinea-pigs are inoculated and Robertson's meat broth tubes are sown, this last for the detection of the presence of anaerobes. From both lots of materials from the stomach smears are made, stained by Gram's method, and examined microscopically. An examination for motility is also carried out under dark ground illumination. Cultures are examined after three days' incubation and again after five and seven days.

Incidence.—The results of the examination of foetuses sent on to Weybridge for diagnosis show some interesting figures.

Year	Foetuses received	Positive for *Br. abortus*	Positive for *V. foetus*
1947	141	26 (18·4%)	3 (2·1%)
1948	171	44 (25·7%)	7 (4·1%)
1949	213	49 (23·0%)	16 (7·5%)
1950	329	37 (11·2%)	34 (10·3%)
1951	448	62 (13·8%)	52 (11·6%)
	1,302	218 (16·7%)	112 (8·6%)

Specific organisms (other than the two mentioned above) which might have been implicated in the abortions were present in a further 5 to 10 per cent. of cases. Between 10 and 15 per cent. of examinations proved sterile or practically so, and the remainder were contaminated to a greater or lesser extent, thus minimising or obviating the chances of isolating organisms likely to have pathogenic significance. (It should be pointed out that each examination has been followed by a biological test for *Br. abortus*.)

The 112 foetuses found positive for *V. foetus* originated in 90 herds situated in Berkshire (5), Buckingham (1), Carmarthen (2), Cheshire (1), Cumberland (1), Derby (1), Durham (1), Flint (1), Hampshire (38), Hertfordshire (1),

Inverness (2), Kent (1), Lanark (2), Lincoln (1), Northampton (5), Shropshire (1), Somerset (5), Suffolk (5), Surrey (18), Sussex (10), Wiltshire (8) and Yorkshire (2).

The ages of these aborted foetuses were as follow: 38 days—1; 2 months—1; 10 weeks—1; 3 months—5; 4 months—8; 5 months—30; 6 months—39; 7 months—15; 8 months—3; unknown—9.

The Organism.—V. foetus is a spiral type of organism which stains well with either Gram or dilute carbol-fuchsin. In direct smears from the stomach contents of the foetus, vaginal discharges and elsewhere, it appears as an "S"-shaped body with one, two or several spirals, but often (and this particularly in smears from the stomach contents) has the appearance of a flying seagull. In cultures, longer forms may be found and apparently these are made up of a variable number of the spirals joined end to end. Granular forms are found, generally in older cultures. Growth is delicate and is dependent on a reduced oxygen tension. Single colonies may vary in size from a pin point to a pin head and may have a glistening "dew-drop" appearance. Larger colonies may be found which, at first glance, may resemble colonies of *E. coli*, or non-haemolytic streptococci. On primary isolation, however, discrete colonies may not be seen and all that may be found is a slight "hazing" or "frosting" of the surface of the media—in consequence we have made a practice of making smears from all slopes and plates, whether growth is apparent or not. During our earlier work difficulty was experienced in cultivating the organism but, with improved technique, we have little difficulty in keeping strains established. Various types of media have been tried and we have found that good results are obtained from 10 per cent. defibrinated ox-blood agar, particular attention being paid to the *p*H.

To demonstrate or isolate the organism from the foetus, etc., it is essential that the material should be as fresh as possible, for some evidence exists to suggest that the vibrios may die off quickly in the presence of contaminants such as *E. coli*.

Field Investigations

Between 1948 and 1950, enquiries made from many of the practitioners who had sent us positive foetuses resulted in the information that in the 51 herds involved a marked "herd infertility" was present in 19; in five, a similar picture had been encountered in the recent past but breeding apparently had since returned to normal; in five, a "herd infertility" had existed in the past but although it appeared that this had cleared up in the cow portion of the herd, at the time of the enquiry difficulty was being experienced in getting the heifers to settle; in six, the infertility present was described as "vague" and in another two the information was that breeding was, and had been, normal. No details were obtained concerning the remaining herds.

With the co-operation of the practitioners concerned visits of investigation were made by one of us (J. R. L.) to 25 of these herds, and, in addition, to another 11 herds in which diagnosis had been made by means other than foetal examination, *e.g.*, by demonstration of the organism in the vaginal mucus or by the results of agglutination tests carried out on vaginal mucus. In 19, a marked "herd infertility" was found to be present. In 11 of these herds infection was found to have been introduced by the bull, in three by cows which had been served by a neighbour's infected bull and which, on returning to service, had been served by the stock bull, who in turn apparently became infected and spread the condition throughout the herd; while in the remaining six cases the origin of infection could not be ascertained with any degree of certainty. In six, a history of a past outbreak of infertility was found, but at the time of the enquiry only vague infertility was present (in two of these herds a diagnosis of trichomonas infection had been made when the infertility was rife, the diagnosis having apparently been made on the clinical history). Four herds had a breeding history similar to that outlined above, but, although the conception rate amongst the cows was found to be reasonably good, a considerable degree of infertility persisted amongst the heifers—in these herds the stock bull served both cows and heifers. In four herds, only a certain proportion of the animals in each had been mated to an infected bull before the infection was noted and immediate measures applied to limit the spread—it is interesting to note that in these cases the infertility remained confined to the "infected" portions. Of the remaining six herds one was a "flying" herd; in two herds cows had been taken to neighbouring premises for service by an infected bull, and subsequently aborting, had been sold; while in the remaining three herds no history of infertility, past or present, could be found.

(In the classification of infertility in the herds outlined above, the term "herd infertility" has been used when over 30 per cent. of the animals were affected; "infertility" when under 30 per cent. were concerned; and "vague infertility" when the conception rates were somewhat below normal throughout the herd.)

Visits were also made to numerous herds in which the diagnosis of infection was made on clinical grounds, *e.g.*, the history, or where an obvious link-up with diagnosed cases existed, through the movement of an infected bull, and so forth, but in which no opportunity was available to obtain material for definite confirmation. Such visits are not included in the present account.

The following service records of one herd illustrate the method of introduction of infection into the herd by a bull and the consequent spread. Bulls A and B, the adult stock bulls, had been in the herd for years and had shown excellent fertility; Bulls C and D were young bulls which, having been mated with heifers the previous season and proved fertile, were being brought forward as replacements; while Bull E was a previously unused young bull. Bull X, the infected bull, came into the herd on November 8th, 1948, and on December 1st served Cow 5 which, returning to service 44 days later, was again served by Bull X, and settled to that service. Cow 9 was served by Bull X on December 18th and was thought to be in-calf. She came into season, however, 156 days later. Cow 11 was served by Bull X on December 27th and returning to service 52 days later was then served by Bull A. It is interesting to observe Bull A's conception rate prior to and following that service. The records portrayed were copied from the herdsman's service book in November, 1949, after *V. foetus* had been isolated from the foetus of Cow 29.

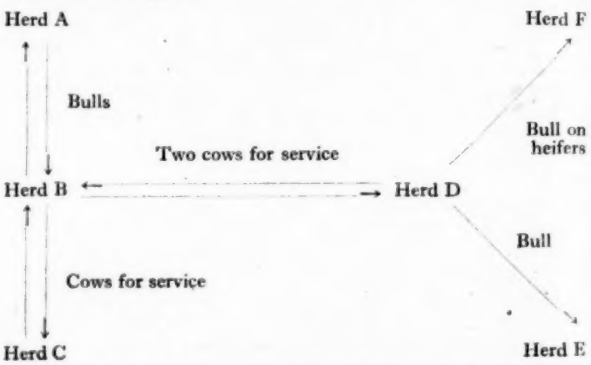
Herd A

No. of cow	Date of service	Bull used	No. of services	Result		Days in cycle	Remarks
				Settled	Turned		
1	8.11.48	A	1st	—			
2	25.11.48	A	1st	—			
3	25.11.48	A	1st	—			
4	28.11.48	A	1st	—			

HERD A (*continued*)

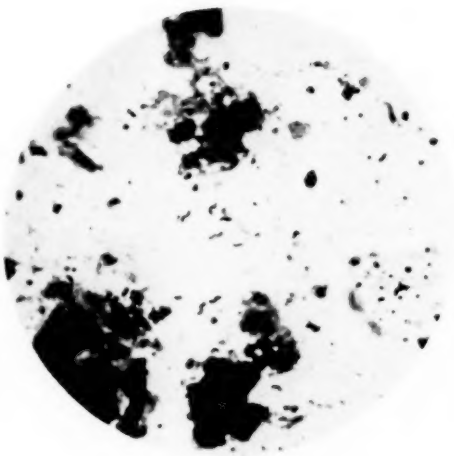
No. of cow	Date of service	Bull used	No. of services	Result: Settled	Result: Turned	Days in cycle	Remarks
5	1.12.48	X	1st		—	44	
6	3.12.48	B	1st	—			
7	6.12.48	A	1st	—			
8	6.12.48	A	1st	—			
9	18.12.48	X	1st		—	156	
10	26.12.48	A	1st	—			
11	27.12.48	X	1st		—	22	
12	28.12.48	C	1st	—			
13	31.12.48	A	1st	—			
14	3. 1.49	A	1st	—			
15	11. 1.49	A	1st	—			
16	11. 1.49	C	1st	—			
17	13. 1.49	X	1st		—	72	
18	13. 1.49	A	1st	—			
5	15. 1.49	X	2nd	—			
19	16. 1.49	A	1st	—			
11	19. 1.49	A	2nd		—	52	
20	24. 1.49	D	1st	—			
21	13. 2.49	A	1st		—	21	
22	17. 2.49	A	1st		—	43	
23	24. 2.49	A	1st		—		Sold
24	25. 2.49	A	1st		—	77	
25	25. 2.49	A	1st		—	56	
26	6. 3.49	A	1st		—	129	
21	7. 3.49	A	2nd		—	33	
11	13. 3.49	A	3rd		—	21	
27	15. 3.49	A	1st		—	21	
28	18. 3.49	A	1st		—	121	
29	19. 3.49	A	1st	—			Aborted, 3.10.49. *V. foetus* isolated from foetus
17	27. 3.49	A	2nd	—			
30	30. 3.49	A	1st	—			
22	2. 4.49	A	2nd		—	144	
31	3. 4.49	A	1st		—	45	
11	3. 4.49	A	4th	—			
32	5. 4.49	A	1st		—	90	
27	6. 4.49	A	2nd	—			
21	10. 4.49	X	3rd		—	176	
25	23. 4.49	X	2nd		—	113	
33	27. 4.49	X	1st		—	28	
34	1. 5.49	X	1st		—	27	
35	5. 5.49	X	1st		—	18	
36	5. 5.49	D	1st	—			
37	13. 5.49	X	1st		—	21	
24	14. 5.49	A	2nd	—			
38	18. 5.49	X	1st		—	19	
39	19. 5.49	X	1st		—	23	
31	19. 5.49	X	2nd		—	80	
35	24. 5.49	A	2nd		—	21	
33	25. 5.49	X	2nd		—		Sold
9	25. 5.49	X	2nd		—	103	
34	29. 5.49	A	2nd		—	123	
37	3. 6.49	A	2nd		—	24	
40	6. 6.49	A	1st		—	48	
38	7. 6.49	A	2nd		—	39	
39	12. 6.49	X	2nd		—	43	
35	15. 6.49	B	3rd	—			
41	21. 6.49	A	1st	—			
42	28. 6.49	A	1st		—	60	
37	28. 6.49	A	3rd		—	118	
43	29. 6.49	A	1st	—			
32	5. 7.49	A	2nd		—	31	
26	14. 7.49	A	2nd		—	23	
38	17. 7.49	A	3rd		—	55	
28	18. 7.49	X	2nd	—			
44	23. 7.49	X	1st		—	34	
40	25. 7.49	A	2nd		—	35	
45	25. 7.49	X	1st		—	36	
39	26. 7.49	A	3rd		—	28	
46	28. 7.49	A	1st		—	56	
47	30. 7.49	A	1st		—	69	
48	2. 8.49	A	1st		—	25	
49	3. 8.49	A	1st		—	71	
50	6. 8.49	A	1st		—		Sold
32	6. 8.50	B	3rd	—			
51	6. 8.49	E	1st	—			
26	7. 8.49	A	3rd		—	76	
31	8. 8.49	B	3rd	—			
25	15. 8.49	B	3rd	—			
39	24. 8.49	A	4th	—			
42	27. 8.49	A	2nd		—	116	
22	27. 8.49	B	3rd	—			
44	27. 8.49	B	2nd	—			
48	28. 8.49	A	2nd		—	29	
40	30. 8.49	A	3rd		—		
45	30. 8.49	A	2nd		—	56	
9	6. 9.49	B	3rd		—		Sold
52	7. 9.49	A	1st		—	23	
38	11. 9.49	B	4th	—			
53	18. 9.49	E	1st	—			
46	23. 9.49	E	2nd	—			
54	26. 9.49	E	1st	—			
34	29. 9.49	B	3rd		—		Not in-calf
48	27. 9.49	B	3rd	—			
52	1.10.49	E	2nd		—	27	
55	4.10.49	A.I.	1st	—			
21	4.10.49	A.I.	4th	—			
47	7.10.49	A.I.	2nd		—	54	
56	12.10.49	A.I.	1st	—			
49	14.10.49	A.I.	2nd		—	21	
57	19.10.49	A.I.	1st		—	21	
58	23.10.49	A.I.	1st	—			
26	23.10.49	A.I.	4th		—	32	
59	23.10.49	E	1st	—			
37	25.10.49	A.I.	4th		—	28	
60	25.10.49	A.I.	1st	—			
45	26.10.49	A.I.	3rd		—	29	
52	28.10.49	E	3rd		—	21	
49	5.11.49	A.I.	3rd	—			
57	11.11.49	A.I.	2nd	—			
52	19.11.49	A.I.	4th	—			

The following chart may serve to illustrate some of the evidence which led to the belief that the infertility was venereal in origin.

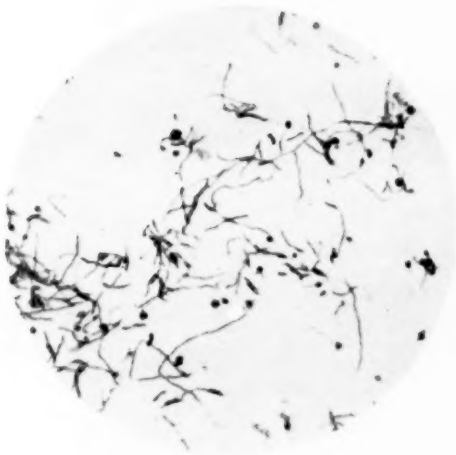


The herds shown were self-contained and, with the exception of Herd C, pedigree. Herds A and B, several miles apart, were under the same ownership but kept as separate concerns, and to and fro movement of stock, apart from bulls, did not take place. During 1948-49, infertility was widespread in both herds but it was not found possible to establish the origin. Herd C was in close proximity to Herd B and when the bull then on the Herd C premises was injured the cows were walked to Herd B for service by whatever bulls were in use there. These cows became infertile. For the sake of the pedigree, two cows from Herd D were sent to Herd B for service. Both returned to service, one at 35 days, the other at 37, and were then served by one of the bulls on the home premises, whose fertility previously had been excellent. Analysis of the records of animals subsequently served showed a conception rate of 12 per cent. to first and second services. Before the infertility became apparent two bulls which had served returned cows left Herd D.

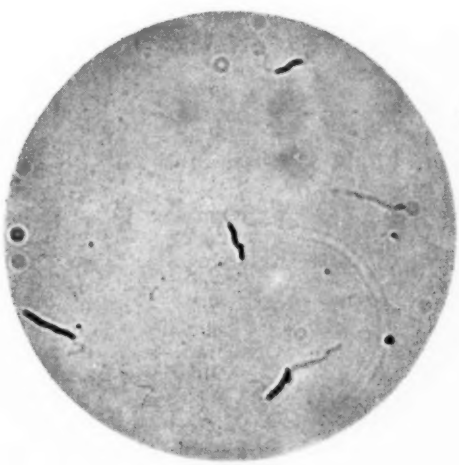
J. R. LAWSON AND D. J. MacKINNON: *VIBRIO FOETUS* INFECTION IN CATTLE



Smear from stomach contents of a foetus showing *V. foetus* organisms. (× 800)



Smear from culture of *V. foetus*. (× 800)



V. foetus organisms, showing flagellae. (× 1,300)

JAS. K. BATEMAN: INJURIES TO THE STIFLE JOINT IN YOUNG GREYHOUNDS

One was sold to Herd E and the service records there suggested that the infertility which became prevalent was introduced by the purchased bull. In Herd E the breeding programme was such that to avoid the old stock bull, who had been on the premises for several years, having to be mated with his daughters, a bull (the other bull referred to above) was borrowed from Herd D to service the heifers. Of 10 heifers mated to this bull three became pregnant, three were sold as barren and the remaining four after repeated services by the borrowed bull were then served by the old stock bull on the premises. He also became infected, and spread the disease throughout Herd F.

Symptoms

The infertility we believe to be associated with *V. foetus* infection closely resembles Trichomoniasis in many respects. The infected animals return to service at irregular periods which are generally over the normal 21-day cycle—animals believed to be in-calf may come into oestrus even after several months. There is often an increased flow of mucus from the vagina, but the degree and amount may vary considerably from only a slight increase to a copious flow in cases in which organisms such as *C. pyogenes* are also present (as secondary invaders). Examination of the genitalia may show little change except, occasionally, some reddening of the vaginal mucous membrane, particularly around the cervix. The abortion rate of recognisable foetuses is seldom high; it appears, however, that conception may actually occur but is followed by foetal death, with subsequent absorption or expulsion of the foetus in a blob of mucus. (In the limited number of uteri from "barren" heifers that we have been able to examine, definite evidence of pregnancy has been found in nearly all.)

The infertility may be acute, subacute, or chronic. The acute form is generally found when infection is first introduced into a "clean" herd by an infected bull. A disastrous fall in the conception rate follows (cases of below 10 per cent. conception have been encountered) and may last for several months or more. Later, the animals appear to develop some degree of tolerance and a gradual return to normal breeding may then follow. In herds in which the stock bull is used on cows *and* heifers it will be found that, while the majority of the cows may eventually conceive, the infertility may continue in each successive lot of heifers and any bought-in animals. On the other hand, if the maiden heifers are mated with a young ("virgin") bull, some difficulty may be encountered in getting them in-calf when, after calving, they are served by the stock (and infected) bull. In some herds the infertility clears up comparatively quickly while in others the condition passes on to a chronic form.

While it is possible that other channels may be involved, the mass of evidence points to the condition being venereal in character and spread by coitus. We have repeatedly met cases where infection has obviously been carried from herd to herd by the bull and further, as has already been pointed out, we have encountered cases in which only a portion of the herd having been served by an infected bull, the infertility has remained confined to that part, while, in the remainder of the herd, served either by a clean bull or by artificial insemination, normal breeding continued.

Examination of the bull may show no abnormalities in the genitalia and the semen may appear to be of normal standards.

Diagnosis

Definite diagnosis of *V. foetus* infection can be made by the demonstration, or isolation, of the organism. In the foetus the most fruitful site is the stomach contents (of the 112 positive foetuses recorded here 70 have been found positive on direct smear *and* on culture; 37 proved positive on culture although no organisms were seen on direct smear, and in five cases although innumerable organisms were seen on direct smear, cultures proved sterile). Serum agglutination tests, using *V. foetus* antigens, have proved of little value from a diagnostic point of view.

A considerable amount of work has been done on an agglutination test on samples of vaginal mucus. This test is an adaptation of Pierce's (1946, 1947, 1949) mucus agglutination test for Trichomoniasis and is dependent on the extraction of the soluble antibodies from the mucus. As a diagnostic agent the test shows some degree of promise and details concerning the technique, etc., will be published later.

Treatment

The treatment advocated has been a three months' period of sexual rest, after which breeding can be resumed, provided that the infected bull is used in the infected portion of the herd, and a young (clean) bull is kept for use on the previously unserved heifers, and subsequently, on them after they have calved and are mated for the second pregnancy. These recommendations may not always be practicable and the alternative is to use artificial insemination, either from the local centre or from a clean bull, with the hope of lessening the spread of infection. Uterine irrigations with iodine, acriflavine or propamadine do not appear to have much beneficial effect. In the laboratory, work done by one of us (D. J. M.) with penicillin and streptomycin has shown that, *in vitro*, *V. foetus* is sensitive to both antibiotics. No opportunity has yet been offered to use these antibiotics in controlled work *in vivo* and we must, therefore, postpone recommending dosage and methods of administration until further work has been carried out.

Experimental Work

Up to last year, although we had obtained a very clear picture of the disease, all the evidence accumulated was circumstantial and accordingly an experiment was arranged to try to reproduce the condition and to ascertain whether or not *V. foetus* was the responsible organism. This experiment, which was commenced in June, 1951, is still in progress but it may be of interest to record some of the results which have been obtained up to the time of writing. It is not possible to give complete details in a paper of this kind and the work will be recorded in full when the experiment has been completed.

Young unserved Ayrshire heifers 18 to 24 months old, and an unused 18 months' old Ayrshire bull, were obtained from herds known to us and which we believed to be free from infection. They were divided into groups which will be defined later and were housed in different sets of premises situated in the neighbourhood of the laboratory. Each of these premises was in complete isolation and was provided with separate attendants. The feeding, which has been chemically analysed, consisted of adequate rations of (*a*) hay, (*b*) concentrates and (*c*) cabbages, kale, mangolds or freshly cut grass according to the season, and was the same for each set of premises.

Two adult Ayrshire bulls which we believed and subsequently proved to be infected were also obtained. These came from a herd which had suffered widespread infertility characteristic of that which we had associated with *V. foetus* infection. Samples of vaginal mucus obtained from cows in the herd had shown marked agglutination when subjected to the *V. foetus* mucus agglutination test and *V. foetus* had been isolated from foetuses. The herd history suggested that infection had been introduced by one of the bulls (Bull X) which had been on hire. On return to his home premises in November, 1948, he was used for service, and of the first 20 cows mated to him, 19 returned to service. Other bulls were used to serve these cows and as a result the infertile condition spread throughout the herd. The second bull obtained (Bull Y) originated in the same premises. His history was that he had been out on hire and had had an excellent record. On return to the home premises in April, 1949, he was mated to cows which had returned to the other bulls. A marked drop in his fertility followed.

The experimental heifers were tied in the stables in their respective premises at the end of May, 1951, and between June and October/November underwent a period of observation and test. The experiment proper as outlined below was then commenced and the results given comprise those obtained up to the beginning of June, 1952. From the beginning, materials as follow were collected from each heifer at regular intervals:—

(1) Blood samples which were subjected to agglutination tests against *Br. abortus* and *V. foetus* antigens; (2) vaginal mucus samples which were subjected to cultural examinations for *V. foetus* organisms and agglutination tests against *V. foetus* antigens.

In addition to these regular routine tests, once the experiment proper was commenced, a sample of vaginal mucus was collected from each heifer at oestrus, immediately prior to either service or insemination and subjected to cultural examination and agglutination test. During the period of preliminary observation each heifer was subjected to the *Br. abortus* and *V. foetus* tests once a month and this procedure was continued throughout the experiment in certain groups. In order that information might be obtained regarding the appearance and persistence of *V. foetus* agglutinins, however, certain other groups were subjected to weekly tests for *V. foetus* and, so that additional data might be forthcoming, one group was similarly tested daily between the fifth and sixth month of the experiment. The results of the various tests will be referred to when the individual groups of heifers are being discussed. Prior to the commencement of services or inseminations each heifer was tested on at least six separate occasions and all cultural examinations for *V. foetus* organisms and serum or mucus tests for *V. foetus* agglutinins proved negative.

The original *Br. abortus* agglutination tests showed that the majority (75 per cent.) of the heifers had titres varying between 1:10 and 1:40, 7 per cent. reacted at 1:80 and the remainder were negative. As each heifer had been inoculated with S.19 these reactions were considered normal. Many of the titres have fallen during the course of the experiment and in no case has any rise in titre occurred.

Through the co-operation of the staff of Dr. Green's department, blood samples from each of the heifers were analysed for copper, calcium and phosphorus levels and through the co-operation of the staff of Dr. Taylor's department mucus samples from each heifer were subjected to mucus agglutination tests for *Trichomonas foetus* agglutinins. In the former tests Miss Lewis reported normal levels. In the latter Dr. Joyner reported all negative except two, these being classified as "doubtful" and on retest the two doubtfuls were returned as negative. These biochemical and *T. foetus* tests were carried out twice, once during the period of preliminary observation and once after the experiment proper had been under way for some time.

Semen samples from Bulls X and Y had been collected and examined by Mr. D. W. Deas on several different occasions prior to the transportation of the bulls to Weybridge and reported as being satisfactory as regards sperm concentration, motility, etc. Throughout our experiment, whenever a collection of semen was made from any of the three Bulls A, X or Y for insemination purposes, cultural examination for *V. foetus* was carried out and a portion of the semen passed to Mr. P. G. Millar to check for concentration of spermatozoa, motility, abnormalities, etc. One sample from Bull Y was condemned because of a leak in the AV and was accordingly discarded, and two others, one from Bull X and one from Bull A, were reported as being low in sperm concentration. Otherwise, satisfactory reports were obtained. *V. foetus* has been isolated in culture on two occasions from the semen of both Bulls X and Y but not on any occasion from Bull A. All three bulls have consistently given negative readings to both *Br. abortus* and *V. foetus* serum agglutination tests.

The semen for insemination purposes was collected at the premises at which the particular bull was housed, transported to the laboratory immediately, and diluted 1 : 6 with equal quantities of fresh egg yolk and sodium citrate buffer which had been adjusted to *p*H 6·7. The diluted semen was stored at 4°C. and used for insemination as soon as possible after the collection had been made. In no case was semen used beyond the third day after collection.

The experiment was designed to supply information concerning the following questions:—

I.—*To ascertain whether the infertile condition met in the field could be reproduced by natural and artificial mating.*

Group I. This group (designated the Naturally Infected Group) comprised 30 heifers, and the two infected Bulls X and Y which were housed in loose boxes on the same premises. It was arranged that 12 heifers would be served by, and 12 inseminated with diluted semen from, the infected bulls, served and inseminated animals alternating in the standings in the cowshed. In order that information might be obtained regarding the possibility of infection occurring by contact, or through grooming, etc., however, it was arranged that six heifers to be inseminated with semen from the clean Bull A, would be included in the group and placed so that one would be standing between three exposed heifers. Thus, at the start, in the group of 30 heifers, six heifers were inseminated with diluted semen from the clean Bull A, six were served by and six inseminated with diluted semen from the infected Bull X, and six were served by and six inseminated with diluted semen from the infected Bull Y. As and when any exposed heifer returned to service or insemination by infected Bull X or Y she was thereupon re-served by or re-inseminated with diluted semen from the other bull.

On October 8th, 1951, one heifer was mated to Bull X and one to Bull Y. Pure cultures of *V. foetus* were recovered from vaginal mucus samples of both heifers 7 and 10 days afterwards and from these cultures antigens were prepared and have been used throughout the experiment. (Both heifers returned to service and were even-

tually got in-calf after each had been served seven times.) Early in November, all preliminary preparations having been completed, the experiment began. The results shown at foot have been obtained to date. [This table has been substituted by Table Group 1: Naturally Infected Group, on page 772.—*Editor.*]

Thus the 10 heifers known to be pregnant to natural service by the infected bulls required 50 services, *i.e.*, five services per conception, and the 10 heifers known to be pregnant to insemination with semen from the infected bulls required 52 inseminations, *i.e.*, 5·2 inseminations per conception, giving a total for the 20 pregnancies of 102 services or inseminations, *i.e.*, 5·1 per conception and a total to date of 64 services and 67 inseminations for the 24 heifers. The six clean heifers, on the other hand, required 10 inseminations or 1·6 inseminations per conception.

Tests.—Following the first mating (natural or artificial) each of 24 heifers, in the group referred to as " exposed," was subjected to tests and examinations at weekly intervals and at oestrus, while the six heifers in the group inseminated with semen from Bull A and which have been referred to as " clean " heifers, were tested once a month and at oestrus.

Mucus Cultures.—Subsequent to the first service or insemination, *V. foetus* was repeatedly recovered culturally from 22 of the 24 heifers mated naturally or artificially to Bulls X or Y.

V. foetus *Mucus Agglutination Tests.*—*V. foetus* agglutinins developed in the mucus of all 22 heifers referred to above, appearing some 2 to 14 weeks after mating and continuing to date. The other two remained negative throughout.

V. foetus *Serum Agglutination Tests.*—Of the 24 heifers being discussed, seven remained completely negative; 10 others showed some degree of agglutination for a variable period and then returned to negative; while the remaining seven have shown some degree of agglutination throughout.

The evidence suggests that of the 24 heifers described, two failed to become actively infected. Both consistently gave negative readings to the mucus agglutination test and all attempts to isolate the organism from the mucus (61 samples have been examined from both) have proved unsuccessful. One has consistently given negative readings to the serum agglutination test while the other showed a transient reaction which commenced three weeks after insemination and lasted for approximately three weeks. One of these heifers conceived to the first, the other to the second insemination.

The six heifers inseminated with semen from the clean Bull A and placed amongst the exposed heifers have been tested on at least seven occasions following insemination. All tests and examinations for the presence of *V. foetus* organisms or agglutinins proved negative.

II.—*To ascertain whether it was possible to reproduce the infertile condition experimentally, by the addition of* V. foetus *to clean semen.*

Group II (designated the Artificially Infected Group) comprised 12 heifers. When the period of preliminary observation had expired each heifer in the group was inseminated with diluted semen from the clean Bull A to which was added the centrifuged deposit of a three-day-old broth culture of *V. foetus.* As and when return to service occurred the same procedure was followed.

The following results have been obtained to date. All first and second inseminations proved ineffective. One heifer proved to be in-calf to the third insemination (and subsequently aborted—see later), one to the fourth and three to the fifth inseminations. One heifer may be in-calf to the fifth and one to the sixth inseminations, but these possible pregnancies are not sufficiently advanced to allow pregnancy diagnosis to be conclusive. The remaining five heifers are presumably not in-calf to the sixth, eighth, ninth (2), and tenth inseminations, having since returned to service. Thus the five heifers in the group known to be, or to have been, pregnant, required 22 inseminations, *i.e.*, 4·4 inseminations per conception, and the 12 heifers comprising the group have received more than 75 inseminations since the experiment began.

Tests.—Following the first insemination each heifer in the group was subjected to weekly tests and examinations but in order that additional data might be obtained regarding possible cyclic variations in *V. foetus* agglutinins, daily mucus tests were made between the fifth and sixth month of the experiment.

Mucus Cultures.—Following the first inseminations *V. foetus* was repeatedly recovered in culture from each of the 12 heifers.

V. foetus *Mucus Agglutination Tests.*—*V. foetus* agglutinins developed in the mucus of each heifer, appearing between three and eight weeks after the first insemination. In three animals, although the reaction to the test was marked for a period, the agglutination titres gradually fell and now the tests from the animals concerned are showing slight or no agglutination. In the remainder the reactions are still marked.

V. foetus *Serum Agglutination Tests.*—One heifer in the group has given negative tests throughout. One other, the animal which aborted, was negative for a period of about four and a half months but some three weeks prior to her abortion she developed a marked titre. The remainder showed varying agglutination titres which commenced between 2 and 10 weeks after the first insemination, and persisted for periods of between one and five months. Six are now negative, two show slight and two more marked reactions.

As has been stated, one heifer (inseminated three times, and the first animal in the group to settle in-calf) aborted on June 8th, 1952, when five months pregnant. *V. foetus* was demonstrated microscopically in the stomach contents, the cotyledons and uterine exudate and was recovered culturally from stomach contents, lung, spleen and brain of the foetus.

III.—*To ascertain whether it was possible to produce infection* (*A*) per os *or* (*B*) *by the conjunctival route.*

Group III comprised 12 heifers, six being tied on one side of the cowshed and six on the other.

The saline washings of a four-day growth of *V. foetus* on a Roux flask of blood agar were given daily by mouth to each of six heifers (Group III (A)) for 10 days. The centrifuged deposit from a three-day-old broth culture of *V. foetus* suspended in 0·5 ml. of normal saline was dropped into the conjunctival sac of each of the other six heifers (Group III (B)). This conjunctival instillation was carried out twice at an interval of seven days. It was arranged that inseminations of the group would subsequently be spread out over as long a period as possible, so that some of the animals involved would be inseminated after varying intervals.

Results are as follow: Group III (A)—infection by mouth—three heifers are in-calf to the first insemination and one to the second. The remaining two have been inseminated two and four times respectively and are not yet in-calf; Group III (B)—infection per conjunctiva—

four heifers are in-calf to the first, one to the second and one to the seventh insemination. Thus the 10 heifers in the group known to be pregnant required 18 inseminations, *i.e.*, 1·8 inseminations per conception.

Tests.—Following the first insemination each animal in the group was tested at weekly intervals and at oestrus.

Mucus Cultures.—In no case was *V. foetus* recovered from the mucus.

V. foetus *Mucus Agglutination Tests.*—All tests proved negative throughout—each heifer was tested at least 25 times.

V. foetus *Serum Agglutination Tests.*—*V. foetus* agglutinins were demonstrated in the serum of all six heifers in Group III (A) (infection by mouth), appearing between two and three and a half weeks after the feeding by mouth had been commenced, and generally lasting for a period of between two and seven weeks. In two heifers some agglutination persisted beyond this period but at present only one animal is continuing to show a slight reaction.

In Group III (B) (conjunctival route) four heifers failed to develop any agglutinins but the remaining two showed a slight degree of agglutination which appeared two and four weeks respectively after the conjunctival exposure. The reactions lasted for about three weeks. Both animals returned to negative and have remained negative since.

IV.—*To ascertain whether it was possible that the infertile condition might have been caused by a filterable agent.*

Group IV (designated the Filterable Agent Group) comprised 12 heifers which were treated as follows. Semen samples from the infected Bulls X and Y were passed through a Seitz E.K. filter and when any heifer in the group was inseminated 1 c.c. of the filtrate was added to 1 c.c. diluted semen from the clean Bull A. Six heifers were thus inseminated with semen filtrate from Bull X and six with semen filtrate from Bull Y, added to semen from the clean Bull A at the time of insemination. On return to service each heifer was re-inseminated in accordance with this procedure. Cultures were made from the filtrate on each occasion and always proved sterile. Results are as follow: six heifers are in-calf to the first insemination, two to the second, one to the third, one to the fifth and one to the sixth insemination. The 12th heifer failed to show regular visible signs of oestrus and was inseminated once only. Conception did not occur. Thus the 11 heifers in the group known to be pregnant required 24 inseminations, *i.e.*, 2·2 inseminations per conception.

Tests.—Each heifer in the group was tested at monthly intervals and at oestrus.

Mucus Cultures.—These proved negative throughout.

V. foetus *Mucus and Serum Agglutination Tests* proved negative throughout.

V.—*To ascertain the effect of the addition of certain antibiotics to infected semen.*

Group V (designated the Antibiotic Group) comprised 12 heifers. Six were inseminated with diluted semen from Bulls X and Y to which were added 1,000 units of penicillin per c.c. of diluted semen, and six were inseminated with diluted semen from Bulls X or Y to which 1,000 units of streptomycin per c.c. of diluted semen were added, shortly before insemination. On return to service each returning heifer was re-inseminated in a similar manner. Results are as follow:—

	Penicillin treated	Streptomycin treated
In-calf to 1st insemination	1	1
„ 2nd „	1	1
„ 3rd „	2	0
„ 4th „	1	0
„ 6th „	0	2
Not in-calf to 7th insemination	1	1
„ 9th „	0	1
	6	6

Thus in the penicillin-treated batch, the five heifers known to be pregnant required 13 inseminations and in the streptomycin-treated batch the four heifers known to be pregnant required 15 inseminations, *i.e.*, 2·5 and 3·7 inseminations per conception respectively, the nine pregnant animals in the group receiving 31 inseminations, *i.e.*, 3·4 inseminations per conception.

Tests.—Each heifer in the group was tested at weekly intervals and at oestrus.

Mucus Cultures.—Following the first insemination *V. foetus* was repeatedly recovered in culture from eight heifers in the group, the other four (two penicillin treated and two streptomycin treated) remaining consistently negative to date in a total of 130 examinations carried out.

V. foetus *Mucus Agglutination Test.*—Marked agglutination was shown by each of the eight heifers referred to above. Agglutinins appeared 4½, 6, 13 and 14 weeks respectively after the first insemination in the penicillin-treated batch, and 7, 8, 13 and 14 weeks respectively after the first insemination in the streptomycin-treated batch. Reactions continue to be marked to date. The four heifers which proved negative to the cultural examinations failed to exhibit any reactions to either mucus or serum agglutination tests.

V. foetus *Serum Agglutination Tests.*—Apart from the four negative heifers referred to above, one other heifer failed to show any signs of serum agglutinins. One showed some slight reaction which commenced about three weeks after the first insemination and lasted for about three weeks. In the remainder agglutinins appeared three to four weeks after the first insemination and some agglutination is still being shown. The evidence suggests that four heifers in the group have remained uninfected to date, all examinations carried out having failed to reveal the presence of *V. foetus* organisms or agglutinins. Two were inseminated with penicillin-treated semen from both Bulls X and Y and two were inseminated with streptomycin-treated semen which also originated from each of the bulls. The former two proved in-calf to the first and second inseminations and the latter two to the second and third inseminations.

VI. Group VI (Healthy Control Group).—This group comprised 12 heifers and the clean Bull A which was housed on the same premises. Six were served by and six inseminated with diluted semen from Bull A.

Results are as follow:—

Served heifers		Inseminated heifers	
In-calf to 1st service ...	3	1st insemination	3
„ 2nd „	0	2nd „	2
„ 3rd „	1	3rd „	1
„ 7th „	1		

Thus the five served heifers known to be pregnant required 13 services, *i.e.*, 2·6 services per conception, and the six inseminated heifers known to be in-calf, 10 inseminations, *i.e.*, 1·6 inseminations per conception, the 11 known in-calf animals in the group requiring 23 services or inseminations, *i.e.*, 2·1 per conception.

The remaining heifer was served twice and was diagnosed as being in-calf at six weeks. A re-check at 10 weeks confirmed the diagnosis but she came in oestrus 100 days after the second service. No foetus was found and no discharges were noticed. Since then she has been served twice and it is not known yet whether she is pregnant.

Tests.—Each heifer in the group was tested at monthly intervals and at oestrus.

Mucus Cultures, V. foetus *Mucus Agglutination Tests* and V. foetus *Serum Agglutination Tests* proved consistently negative.

Note On Mucus Examinations

An increased flow of mucus was a constant feature for four or five months in practically all the exposed heifers, but this is now no longer apparent. The increase began four to seven days after service or insemination and was most marked.

As the experimental work progressed it became increasingly clear that considerable fluctuations occurred in the mucus cultural examinations and agglutination tests. It was observed that, in samples of mucus collected from the same animals over a period, *V. foetus* was more readily isolated at oestrus than at other times in the cycle, and that agglutination tests on oestral mucus showed negative, or very low, titres whereas marked reactions were exhibited at other times. An analysis of the results obtained from the infected animals showed that while 83·1 per cent. of samples of oestral mucus were positive on culture, only 26·5 per cent. of samples collected at other phases of the cycle were positive. Where the agglutination tests are concerned, of the samples collected at oestrus only 21 per cent. showed a reaction whereas 91 per cent. of the samples taken at other times gave agglutination.

Conclusions

(1) Healthy heifers served by or inseminated with semen from bulls with a previous history of infertility developed varying degrees of infertility as evidenced by low conception rates. From these heifers, *V. foetus* was isolated by cultural examination of the vaginal mucus and *V. foetus* agglutinins were demonstrated in the vaginal mucus.

(2) An infertile condition indistinguishable from this, and abortion, was produced when healthy heifers were inseminated with fertile semen to which *V. foetus* culture had been added.

(3) This infertile condition was not due to a filterable agent.

(4) This infertile condition was not produced when healthy heifers were fed with *V. foetus* cultures nor when *V. foetus* cultures were instilled into the conjunctival sacs.

(5) This infertile condition was not transmitted by ordinary day-to-day contact in the cowshed.

(6) Penicillin and streptomycin, as used in this experiment, have little value in the treatment of *V. foetus* infected semen.

(7) The *V. foetus* serum agglutination test is of little practical value as a diagnostic agent.

(8) The *V. foetus* mucus agglutination test is a valuable aid to diagnosis provided samples for testing are not collected at or around oestrus.

Summary

An account is given of the laboratory work and field investigations which led to the belief that *V. foetus* was responsible for causing abortion and infertility in cattle.

The preliminary findings of a transmission experiment which is being carried out at Weybridge are given. The results of the experiment, which involves 90 heifers and three bulls, indicate that *V. foetus* is pathogenic to cattle, causing infertility and abortion.

Acknowledgments.—The authors wish to thank Sir Thomas Dalling for his help in the earlier part of the experiment; Dr. Stableforth for his help and encouragement throughout, and for his kindly criticism in the preparation of this paper; Mr. Hudson for many helpful suggestions; Mr. D. W. Deas for help in the selection of the bulls; Mr. P. G. Millar for carrying out the semen examinations and checking the pregnancy diagnosis; Dr. Ruth Allcroft and Miss Lewis for carrying out the biochemical analysis; Dr. Joyner for carrying out the test for Trichomoniasis; our colleague Mr. C. C. Bannatyne, and Mrs. Martin and the other members of our technical staff for their conscientious work in the laboratory; Mr. A. Norman for the photographic work; Mr. R. McNeil for arranging the housing and maintenance of the animals; and all the Animal Attendants (in their isolation) for the unremitting care and attention they gave to our experimental animals.

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Amplifying his paper, as invited, Mr. Lawson said: I would like to refer to the paper as it has been printed (I take it that it has been read). You will see that it is divided into sections dealing with (1) Introduction,

Laboratory Work, Field Investigations, Symptoms, Diagnosis and Treatment, and (2) Experimental Work. The sections covered by (1) were the basis of papers on the subject presented to several Divisions of the B.V.A. in 1951, *i.e.*, the Scottish Metropolitan in February, the South Wales in June and the Southern Counties in December. The Chairman has pointed out that our time is very limited and I will accordingly confine myself to referring briefly to the section (2), *i.e.*, the Experimental Work that is being carried out at Weybridge. The results collected up to June of this year are as printed, but as the continuation of the work has made available further information concerning the service and insemination rates, etc., with the aid of the epidiascope, I would like to demonstrate the present state of affairs in the various groups of experimental animals described in the paper before you.

In the paper we stated that the infertile condition was not produced when healthy heifers were fed with vibrio cultures, but since the paper was printed one animal in the feeding group, Group 3A, has aborted, and another has developed agglutinins in the vaginal mucus. We were unable to recover any organisms from the foetus or placenta, and to date have been unable to demonstrate any *V. foetus* organisms or agglutinins in the vaginal mucus of the aborted animal.

GROUP II

ARTIFICIALLY INFECTED GROUP

	Heifers inseminated with semen from clean Bull A to which *V. foetus* organisms had been added	Observations
Heifers in calf to	1st insemination = 0	
	2nd " = 0	
	3rd " = 1	Subsequently aborted, *V. foetus* recovered from foetus.
	4th " = 1	
	5th " = 4	One subsequently aborted twins, *V. foetus* not recovered from foetuses.
	6th " = 1	
	7th " = 0	
	8th " = 1	
	9th " = 0	
	10th " = 0	
	11th " = 1	
	12th " = 1	
Heifers not in calf to	12th " = 2	Further inseminations not carried out.
Total heifers	= 12	
Total inseminations	= 88	
	i.e., 6·4 inseminations per known conception.	

GROUP I

NATURALLY INFECTED GROUP

	Heifers served by or inseminated with semen from infected Bulls X or Y		Heifers inseminated with semen from clean Bull A
	Served	Inseminated	Inseminated
Heifers in calf to	1st service = 0	1st insemination = 1	1st insemination = 3
	2nd " = 0	2nd " = 1	2nd " = 2
	3rd " = 2	3rd " = 1	3rd " = 1
	4th " = 2	4th " = 0	
	5th " = 2	5th " = 3	
	6th " = 2	6th " = 1	
	7th " = 2	7th " = 1	
	8th " = 1	8th " = 2	
	9th " = 0	9th " = 1	
	10th " = 0	10th " = 1	
Heifer possibly in calf (but pregnancy diagnosis not yet carried out) to	10th " = 1		
Total heifers	= 12,	= 12	= 6
Total	Services = 68	Inseminations = 69	Inseminations = 10
	i.e., 5·3 services per known conception.	*i.e.*, 5·7 inseminations per known conception.	*i.e.*, 1·6 inseminations per known conception.

GROUP III

	A. Infection by mouth	B. Infection per conjunctiva	Observations
	Inseminated with semen from clean Bull A		
Heifers in calf to	1st insemination = 3	1st insemination = 4	
	2nd " = 1	2nd " = 1	
	5th " = 1	5th " = 0	
	7th " = 0	7th " = 1	
Heifer not in calf to	3rd " = 1		Occluded cervix? No further insemination attempted.
Total heifers	= 6	= 6	
Total inseminations	= 13	= 13	
	i.e., 2·0 inseminations per known conception.	*i.e.*, 2·2 inseminations per known conception.	

Because of the appearance of agglutinins in the mucus of the second heifer, it is possible that our original conclusions may have to be modified. It seems likely, however, that if infection occurs other than by the venereal route it must be rare.

GROUP IV
FILTERABLE AGENT GROUP

	Inseminated with semen from clean Bull A plus filtered semen from infected Bulls X and Y	Observations
Heifers in calf to	1st insemination = 6	
	2nd " = 2	
	3rd " = 1	
	4th " = 0	
	5th " = 1	
	6th " = 1	
Heifers not in calf to	2nd " = 1	Irregular cycle. Dirty discharge. *C. pyogenes* recovered from mucus. Further inseminations not carried out.
Total heifers	= 12	
Total inseminations	= 26	
	i.e., 2·2 inseminations per known conception.	

GROUP V
ANTIBIOTIC GROUP

	Inseminated with semen from infected Bulls X or Y		Observations
	Penicillin treated	Streptomycin treated	
Heifers in calf to			
1st insemination	1	1	
2nd "	1	1	
3rd "	2	0	
4th "	1*	0	* Subsequently aborted, *V. foetus* recovered from foetus and placenta.
5th "	0	0	
6th "	0	2	
7th "	0	0	
8th "	0	1	
Heifer possibly in calf (but pregnancy diagnosis not yet carried out) to 10th insemination	0	1	
Heifer not in calf to 10th insemination	1	0	
Total heifers	6	6	
Total inseminations	23	33	
Inseminations per known conception	2·6	4·6	

GROUP VI
HEALTHY CONTROLS

	Served by or inseminated with semen from clean Bull A		Observations
	Served	Inseminated	
Heifers in calf to	1st service = 3	1st insemination = 3	
	2nd " = 0	2nd " = 2	
	3rd " = 1	3rd " = 1	
	6th " = 1		
	7th " = 1		In calf to 2nd service, but returned at 100 days and re-served.
Total heifers	= 6	= 6	
Total	Services = 19	Inseminations = 10	
	i.e., 3·2 services per known conception.	*i.e.*, 1·6 inseminations per known conception.	
	Or, for the Group, 2·4 services or inseminations per known conception.		

In conclusion, may I suggest that the evidence we put before you indicates that the organism *V. foetus* is pathogenic to cattle, causing infertility and abortion. We believe that the infection is widespread throughout the country and is of paramount importance in cattle breeding to-day.

The CHAIRMAN: Thank you, Mr. Lawson, for ably elaborating on your paper with those rather up-to-date remarks. I now have great pleasure in introducing our opener of the discussion, Mr. G. S. Powley, who is a general practitioner in Yorkshire and has many dairy herds under his control. I am sure you will all be very interested in his remarks. (Applause.)

DISCUSSION

The discussion was opened, as follows, by Mr. G. S. POWLEY, M.R.C.V.S., of Wetherby, Yorks:—

When I received the rough proof of Mr. Lawson's paper about three weeks ago I felt rather as I imagine millions of people must feel on a Saturday night when they start to check their football coupons! I turned over the pages very rapidly until I came to "treatment." There I thought I was going to find the answer to all my troubles. And there it was, about 20 lines of it. Being in practice and having clients to satisfy, I thought, well, bang goes £75,000, I have still to go on trying in the same old way.

Before I go on to deal with my efforts in trying to treat *V. foetus* I should just like to make one or two points about the symptoms as I have found them. The first point I want to make is on the question of pregnancy diagnosis and how misleading it can be.

I remember when I was a member of that noble band of sterility officers in 1941 going round the country. At that time we were meant to be sterility officers investigating infertility in cattle, but our main occupation seemed at that time to be trying to demonstrate to the practitioner how to carry out pregnancy diagnosis. I went round demonstrating how to palpate pregnancy, and was very satisfied with all I had done. So was the practitioner very pleased; he had been able to feel everything, too. Then he would ring me up two or three months after and say, "Will you come again to have another look at a herd or two?" After we had gone

through all the herds and cattle we would be sitting down having a drink and he would say, "By the way, you remember that herd we examined the last time you were here, four or five of those cows you said were in calf, are not." I would say, "You felt the things as well as I did," and he would reply, "Yes, but I don't know anything about it. You do!"

The point I am trying to get at is how misleading this pregnancy diagnosis can be where *V. foetus* is present in the herd.

The other point I have been concerned with as I have gone round examining cases of *V. foetus* is the state of the genitalia. In every case, by manual palpation I have never been able to detect anything wrong or notice any signs of inflammatory change taking place in the vagina. Mind you, I have not spent much time making a careful examination of the cervix, but that was one of the points which was most baffling; one could not find anything to account for this abnormal oestral cycle we were getting.

Mr. Lawson in his paper uses, I think, a very good and clear description of the early expelled foetus. He says that it appears as a blob of mucus, and that word "blob" I have heard mentioned on several occasions by herdsmen and farmers alike and I do think it is a very apt description. If that blob is found in the dung channel it is one of the signs that there is possibly vibrio infection.

Being in practice I have had to treat these animals. One cannot just go on to a farm and say, "You have got vibrio—there we are." One has to do something, and I should like to try to tell you about my efforts and of how I have tried to tackle this job. No doubt you will all tell me I have been wasting my time! That is for us to decide here this morning.

Unfortunately, I have not been able to collect any figures or other data to illustrate, or give any concrete reasons for my thinking I have had some success with penicillin treatment, but I still dare go on to my clients' premises and I am greeted with a cheery smile, and a contented look on the cows' faces! That gives me some hope that I have not been actually wasting my time or my clients' money on penicillin.

The bulls received an intramuscular injection of 3,000,000 units of penicillin once a day for four days. On the second day all the hair round the end of the sheath has been clipped off and thoroughly washed. On nearly all occasions I have persuaded the owner to wash the bull completely from top to bottom. Then on the third day the sheath has been washed out with warm water and dettol two or three times and the animal has been removed to a clean box with clean straw. I have, of course, carried on with the injections on the third and fourth days. Before the animal has been used I have persuaded the owner to rest it for at least three weeks.

The cows I have treated in the same way, on two farms. They were not given as heavy a dose of penicillin as a bull; making a variation according to whether they were Jerseys or Ayrshires, I gave 1,500,000 units of penicillin to the Jerseys and 2,000,000 units to the larger animals.

The vagina was washed out with warm water and mild antiseptic; the root of the tail and all round the vulva was washed and cleansed.

Another method of treating the cow was by irrigating the uterus, both horns, with 300,000 units of penicillin and leaving it at that. By Mr. Lawson's records which have been shown this morning it looks as if I have been wasting my time, but I have definitely had improvement in the conception rate.

On other premises, possibly where the farmer has not had the capital to allow me to try the penicillin treatment, I have tried to divide the herd into two and have kept a clean maiden bull for heifers and have allowed the farmer to carry on with the infected bull serving the dirty animals.

As far as I can see, that is going to work only for a time and the difficulties will arise later on. If the farmer does not keep accurate records, or has a casual herdsman, later on he will start getting his cows mixed up and before we know where we are we shall be back where we started. A herdsman may notice that a cow is in season and it had better be served. Maybe the owner is not there and accidentally the cow is served by the dirty bull; the owner does not realise what has happened and he puts on the clean bull, and then all your efforts are wasted and you start again.

There is just one other thing I have found, *viz.*, it is no use treating only the animals suspected of being infected; one must treat the whole herd. I had one particular case where we traced back and we knew where the infection had come from; we traced the cow and the exact date. A neighbour's cow had been brought in and served by the bull and we knew from that date which animals had been infected and we treated only those animals and, of course, the bull. For some reason that did not seem to work. Whether the infection was there or not before the date I do not know, but we did have a very serious breakdown again after all our efforts.

Before I came on to the platform this morning I was informed that time was very scarce and so with these few remarks I am going to sit down. I know there are quite a number of members present this morning who are convinced that *V. foetus* does not cause any serious trouble in our cattle and it is those gentlemen I think we are wanting to hear.

There is just one question I should like to ask Mr. Lawson, about the collection of mucus samples. He said they must not be collected at or around oestrus. I have tried to take several samples and have had great difficulty in getting sufficient mucus at any length of time after oestrus, and I should like to know what is the best time to collect the mucus?

I should also like to thank Mr. Lawson very much indeed for a most full and informative paper. (Applause.)

General Discussion

The Chairman: The subject was now open to general discussion. As Mr. Powley had suggested, there might be a large number of questions, and therefore those who spoke were again asked to be as brief as possible so that as many questions as possible might be put in the time available.

Mr. G. F. Smith (Beccles): He wished to add his compliments to Mr. Lawson and his colleagues for the considerable contribution they had made in the joint paper; also to Mr. Powley for his practical remarks, and to the Ministry of Agriculture and Fisheries for their foresight and provision of facilities to allow this work to be carried on.

It would be realised that he himself was to some extent connected with artificial breeding and therefore had a considerable interest in this work. With some 500 to 600 bulls it could be assumed that an odd sire might have slipped through the net which the Ministry of Agriculture placed around all bulls coming in to A.I. centres.

It was reasonable just to point out the various steps he and his colleagues endeavoured to take in picking out these bulls. First and foremost, they relied to some extent, despite what Mr. Lawson said, on the antibiotics. Mr. Hunter would perhaps be mentioning work in that sphere a little later.

Also, they did tend to rely to some extent on records. A fairly comprehensive system was at work at all centres, whereby the inseminators endeavoured to the best of their ability to mark insemination certificates when maiden heifers were inseminated and a separate conception rate was kept for those animals. They also tried to the best of their ability to interpret that as early as possible in the bull's life at the centre.

Regarding the application of the antibiotics, he liked to try to use a bull for the first month without antibiotics being applied to its semen, in order to see if there was any adjustment in the C.R. upon the application of streptomycin, penicillin or sulphanilamide, or the three combined.

Could the author elaborate on the suggestion that the semen picture was within normal standards? It was Mr. Smith's own experience to feel that microscopically one might be able to associate problem bulls with a somewhat—for the want of a better term—dirty, muddy-looking type of semen.

In relation to treatment of the bull, from Mr. Powley's remarks and the remarks and publications of other workers, it was perhaps reasonable to suggest that the evasive vibrio was associated with the preputial glands, so was the local application of an effective antibiotic perhaps the best line of treatment?

Was there any possibility of applying the mucin agglutination test to the sheath washings from the bull in an effort to weed out the odd bull that might just slip through the net? Also would it be reasonable to presume that there might be both pathogenic and non-pathogenic types of vibrio? In various published papers there

had been suggestions by American workers that a number of strains of vibrio were available, in their country at least.

Would it be reasonable to presume that in Mr. Lawson's introduction of the vibrio to normal semen he would be introducing larger numbers of vibrio than would be expected from the normal processes of either natural service or artificial breeding?

In terminating his remarks, he would like to say that they were indebted to Mr. Lawson and his colleagues for their interim report, and they at the same time looked forward to many of the obscurities of the vibriosis syndrome being clarified in the not too distant future.

Mr. W. K. Hunter (Northampton): He wished to join his colleague Mr. Smith, in congratulating Mr. Lawson, especially for the experimental work carried out. He would confine his remarks to some work he and his associates had been doing at two centres on antibiotics. They had started using them following on the initial American work and had now been doing so for over two years. When they had started to use them they had not known why, and so had tried to find a reason, and the obvious one was the control of bacterial contamination of semen.

Over the past two years they had been doing routine cultures of every sample of semen collected, both raw and diluted. A technique had been evolved whereby, with the exception of one organism, the semen used in the field could be rendered bacteriologically sterile. The only organism they could not completely control was *Ps. aeruginosa,* which in a contaminated sample could be cultured after 96 hours of storage, the virulence of the growth, however, being inhibited.

A controlled experiment with split samples of semen using sulphanilamide, streptomycin and penicillin was embarked upon, using the antibiotics singly, in pairs and all together. It was found that in diluted semen treated with sulphanilamide 0·3 per cent., penicillin 500 units and streptomycin 500 μg. per c.c. the growth of all organisms including *V. foetus* could be controlled.

However, the semen had to be treated at certain temperatures to allow the antibiotics to act and he would suggest that the reason for the failure reported by Mr. Lawson was that the antibiotic was added when the semen was at too low a temperature.

In their work they found the antibiotics had little effect when added to the diluent at a temperature of less than 16° C. and two techniques had been evolved, namely, to dilute the semen at a temperature of 18° to 22° C., the other at 30° C.

At above 18° C. the growth and spread of organisms in diluted semen could be controlled.

Their routine treatment was to use diluent employing the antibiotics in the concentrations previously mentioned, the diluent being prepared at least four hours before use to ensure that all contaminants in the diluent were killed. It was then stored in a refrigerator and brought up to the specified temperatures before the semen was added to it. In a short time all bacterial contaminants had been killed, even that of the most resistant within 90 minutes. They had also found in their work that penicillin alone did not always control the growth of *V. foetus.*

Dr. J. A. Laing (Bristol): He did not think they could congratulate Mr. Lawson sufficiently on his paper and the work behind it. The experimental work was particularly noteworthy. It was not so very long since *V. foetus* was looked upon merely as a disease of late pregnancy, responsible mainly for abortion and retention of the placenta. It had now been shown, not only that it reduced fertility initially but also was a primary pathogen and did not require the preliminary or additive action of any other organism. He would like to ask Mr. Lawson how often he considered that in the natural disease infection was venereal? There was evidence that other modes of infection could occur and this was a matter of some importance both in the general control of the disease and in the management of individual outbreaks. If, as in trichomoniasis, the venereal route was the only one of practical importance, isolation measures were very much simplified, but if infection could occur by other routes the problem was very much more difficult.

If venereal infection was the chief route, control measures, as things stood at present, seemed to resolve themselves into two main problems, those of *individual* diagnosis in the bull and in cows and heifers. There seemed to be many analogies between vibriosis and trichomoniasis, but it was not known if in vibriosis there was the same pattern of spontaneous cure in females when rested from service so that re-infection ceased. Apart from exceptional cases, in trichomoniasis recovery occurred with such treatment and so the question of individual female diagnosis did not arise. He would be glad if Mr. Lawson could tell them what was the course of events in cows infected with *V. foetus* after a rest period, and if the mucus test could be used for *individual* diagnosis in cows and heifers. He would also like to hear more about Mr. Lawson's views on diagnosis in the bull. The only method at present available was mating of maiden heifers combined with agglutination testing on mucus. That method was rather cumbersome and tedious, and in many cases not very reliable. A more efficient method was desirable because one was often confronted with the problem of a herd in which there were several bulls, one or all of which might be infected. The matter was of very great importance in artificial insemination and the testing of bulls before they went to centres.

It had been shown that infection could take place by artificial insemination and he would not have thought there was any doubt that under practical conditions it was taking place in this country at the present time.

Finally, would Mr. Lawson say a little about the connection, if there was one, between the disease in cattle and the disease in sheep?

Mr. J. A. Moss (Bromsgrove): He wished to speak of the experience of those at Bromsgrove with what they now believed to be an outbreak of vibriosis in A.I. bulls. In the late summer of 1950 one or two bulls had been introduced, one of which was a Friesian, now believed to have been infected. The bull had been introduced to the centre and used to a limited degree in the first month and to a slightly larger degree in the next month. It was then realised that it had a low conception rate—about 30 per cent. An Ayrshire bull had also been introduced some eight months previously. It had had a very high conception rate, about 75 per cent., and had kept up that rate for the first six months of its use. In the month following the introduction of the Friesian bull, the Ayrshire bull's conception rate dropped to 30 per cent., where it remained. Both bulls were taken out of service and from information from the field it became evident that *V. foetus* was involved. Certain maiden heifers that had been inseminated with semen from the Friesian bull and the Ayrshire gave positive results to the agglutination test, and subsequently a vibrio was recovered from the semen of the Ayrshire bull.

It seemed evident that the Friesian bull had got through the net referred to by Mr. Smith, and also that the infection had been transmitted to the other bull at the centre.

Infection in A.I. bulls could, of course, be extremely bad in the field. They had been able to show that where insemination had been carried out in herds where a bull was also used it was possible to transmit the infection to the bull used for natural mating. At the time the Friesian bull was introduced and when the Ayrshire bull apparently became infected, sulphanilamide only was being used in the semen. They started to use penicillin shortly after. At the time the method of control in the use of artificial vaginas at the centre was for individual A.V.s to be used and after use each A.V. was washed in a detergent and boiled. That had always been the method employed.

It appeared that if any transmission of the infection took place at a centre it was something to do with the use of the teaser. It might be just by the connection between the bull at service and the hind quarters of the teaser.

At Bromsgrove they were very interested in the use of antibiotics in the control of this condition. Could experiments described by Mr. Lawson be enlarged upon? He understood that Mr. Lawson had mentioned that the antibiotic was added to the semen just before insemination, and he wondered if that was a fair test of the antibiotics and whether they should not have a longer time in which to kill the infection.

Mr. E. P. Barrett (Guildford): It was time for a practitioner to make a contribution. He was in practice in very close proximity to Wevbridge and wanted to say how very much he appreciated the very willing and excellent help he received from Mr. Lawson and his colleagues in connection with this disease.

In different herds he had noticed a variety of different effects. In one Jersey herd of about 30 cows, there were six abortions in a season and in each case *V. foetus* was isolated from the abort In a number of the remaining cows in the herd diagnosis was made by the agglutination test of vaginal mucus. In this case, infertility was widespread.

In another herd of something like 40 cross-bred Friesians an abortion occurred, and from the abort *V. foetus* was isolated by Mr. Lawson; there were no more abortions, and the fertility rate was reasonably normal for 12 months. After this considerable interval two more abortions had now occurred, but unfortunately the foetuses were not found. Specimens of vaginal mucus were submitted to an agglutination test for *V. foetus* infection, and proved positive in each case.

In a third herd an abortion had taken place and from the abort Mr. Lawson had isolated *V. foetus.* This occurred about 15 months ago. Mr. Barrett had examined the herd for pregnancy to see if there was any significant amount of infertility. Fertility was practically 100 per cent. and had remained so ever since.

Apparently there was some clinical evidence to suggest that three months' rest resulted in immunity developing in the cow, and he wondered whether treatment with an antibiotic was really helpful in that animal. Had anybody got any statistics about its usefulness? It seemed possible that if one cleared the infection from a cow's uterus and vagina with an antibiotic and served her with an infected bull in less than the three months, she might well become infected

again because the antibiotic would be there no longer, and immunity would not have developed.

As regards the collection of vaginal mucus, had Mr. Powley been introduced to the inelegant method of collection by suction through a glass tube? It was not very pleasant, but very effective, if one did not burst a blood vessel in trying to do it.

Mr. I. G. Shaw (Wolverhampton): Mr. Lawson was to be congratulated on the work he had done and it was to be hoped that he felt very happy about it, because the experiment proved what he and many others had assumed would happen.

There was no doubt a great deal of vibriosis present among the dairy cattle population, but Mr. Shaw wondered, when they spoke about vibriosis as a cause of infertility, whether they were quite correct in ascribing all the trouble to the germ itself. From his own experience—and he trusted he would be forgiven for a bit of speculation and prophecy—one might rather think in some cases that one was possibly dealing with other conditions which coincided with the infection. That was said with all due respect to Mr. Lawson's work. There was the possibility that at the time there might be present other infections of which they knew very little. He felt perfectly sure, having come across them, that there were nutritional disturbances which possibly "played up" the infection.

Treatment, no doubt, was uppermost in the minds of people who were concerned with general practice. Unfortunately, it was difficult to carry out controlled experiments in the field, but from results with which he personally was acquainted he could merely endorse what Mr. Barrett had just said. The great variability in results which were achieved was an argument for the point that other factors might be present or it might be that different strains of the organism responded differently.

In some cases, treatment with penicillin or streptomycin had yielded spectacular results in that immediately after treatment service had been resumed without any rest and the results were so striking that one could at once tell by examining the service book when treatment had been carried out. In other cases, treatment yielded hardly any perceptible improvement.

He was just a little sceptical about the treatment of bulls which Mr. Powley had recommended. One could quite follow Mr. Powley's argument, and no doubt the bull benefited from the extensive toilet work carried out. But had it not been shown that the infection also resided high up in the urinary tract? • One could see no reason why that should not apply to the cow as well. It was to be concluded that if treatment was to be at all effective it must be allowed to act throughout the whole of the body and not be applied only locally.

Had Mr. Lawson demonstrated any difference in the pathogenicity of various strains of *V. foetus* and had different strains given different results with the mucus agglutination test? One more rather aggravating property of the organism was its rapid disappearance from the infected material. Could Mr. Lawson state the reason for the sudden disappearance? Was it related to any change of *p*H or the presence of any other contaminated organisms?

Another unusual feature of the disease was the spontaneous occurrence of infertility due to vibrio in closed herds. One was aware that certain closed herds had existed for many years. Owners might be most careful about the introduction of animals, but, suddenly, and for no apparent reason, an outbreak of vibriosis could occur and it was difficult to connect it with any known factor. Was Mr. Lawson able to give any idea as to why that should occur?

Lastly, the paper mentioned recovery of the organism at *post-mortem* from various animals. Was Mr. Lawson able to say in which parts of the genital tract the organism was found? Was it only in the uterus, or did it also come from the cervix, the fallopian tubes or other parts?

Mr. S. L. Hignett (Frant): He wanted to pay tribute to both Mr. Lawson and Mr. Powley, a former colleague, for their most valuable contributions. To Mr. Lawson he would say how refreshing it was to have at the annual Congress a paper largely based on direct experimental evidence, so getting away from the general type of paper which had come to be regarded as the only type to be presented on such occasions.

On the previous day, Mr. Murphy, of Colchester, had remarked to him that he was quite tired of people going up to the platform and immediately apologising because they knew nothing whatever about the subject under discussion, and that he looked forward to the time when someone would get up and say he knew a great deal about the subject. Speaking personally, Mr. Hignett said that when he started to mount the platform steps a few moments beforehand he had felt he knew a great deal about the subject under discussion, but the ordeal of walking across the platform and standing before the meeting gave one an inferiority complex—it gave even him an inferiority complex! (Applause.) "Thank you, ladies and gentlemen, my ego is returning!"

In listening to the discussion he had been reminded of a meeting of the Central Veterinary Society some years ago. A very eminent veterinary surgeon produced on that occasion a specimen of a horn tumour and, having given an excellent dissertation, had been unable to resist the temptation of referring to 40 years' experience of keratoma. During the subsequent discussion another veterinary surgeon referred to 42 years' experience, and this was capped by another who referred to 45 years' experience. Then the oracle, in the form of Professor James Macqueen, struggled to his feet and without opening his lips said: "Mr. President, gentlemen, judging by what we have just heard, the knowledge of the speakers with regard to keratoma is neither extensive nor profound!"

Mr. Hignett recalled that incident because the statement might be regarded as very true of many of the comments made on bovine infertility. He supported the view that vibriosis was an important cause of bovine infertility in this and other countries, but would not, however, go as far as Mr. Lawson. So many workers had in the past attributed undue importance to a single factor but, as a result of hard and grim experience in the field, had been taught the error of their ways.

It had been well known to them for some years now that the herd breeding problem was frequently an extremely complex affair, and it was only by accepting that view that one could hope to explain the very many anomalies associated with vibriosis. Certainly they could not all be explained by strain variation in virulence, the old lifebelt of the bacteriologist.

Two years previously, at Cardiff, he had drawn attention to the necessity for differentiating between *V. foetus* infection and infection with the pleuropneumonia-like organisms, or the p.p.l. as they were called. For a long time he and his colleagues had been making observations on the importance of p.p.l. as a cause of bovine infertility and even now they were not prepared to give a definite opinion. They were accumulating evidence which showed that p.p.l. could be associated with a herd breeding problem, the clinical picture of which was practically indistinguishable from that described for vibriosis.

It was interesting that while *V. foetus* was both penicillin and streptomycin sensitive when tested *in vitro*, the p.p.l. was penicillin resistant and streptomycin sensitive. Mr. Shaw had touched on this. They must not, however, lose sight of the possibility of the influence of environmental factors on *V. foetus* infection. If environment did play a part then, in his excellent experimental work, Mr. Lawson might well have used heifers which were particularly susceptible to *V. foetus* and thus his results might exaggerate the importance of the infection.

If one went through the paper carefully one would see that Mr. Lawson kept quite a number of control animals. The conception rate of those animals, based on first inseminations, was not more than 50 per cent. It was reasonable to assume, therefore, that the experimental animals used were of low fertility. Consequently, the introduction of any pathogenic organism into the genital tract might lead to a further and dramatic fall in reproductive efficiency. From the table, headed Herd A, on page 4 of the paper, it could be seen that for short periods the conception rate was moderate to good in spite of the fact that the animals were being served by infected bulls. In one series seven out of nine animals served became pregnant to a first service and, from a careful study of the table, that temporary improvement in the fertility of the herd could not be explained on the grounds of an acquired tolerance alone.

With regard to cystic ovaries, the view was held in some quarters that *V. foetus* infection led to the development of cystic ovaries. That view was held by no less an authority than Professor Asdell in the States. What did Mr. Lawson think about the observation?

If this work was repeated at Weybridge it might be suggested to Mr. Lawson that the management and feeding of the experimental heifers be changed with the object of getting a higher conception rate in the control groups, and that the precaution should be taken of eliminating every possibility of pleuropneumonia-like organisms being present. There appeared to be no good evidence that p.p.l. was completely eliminated in the experiment reported.

He wished to emphasise that his co-workers and he regarded *V. foetus* infection as the most important single factor contributing to the herd breeding problem in this country at the present time. Over the last three years they had investigated herd breeding problems in 180 herds. From no less than 48 of these *V. foetus* had been recovered. No other single and possible contributory factor had turned up with anything like that frequency.

Let it be remembered that, as in the case of mastitis, the practical solution of the herd breeding problem in this country might well be the control of infective agents, rather tending to leave environmental factors to look after themselves.

Mr. W. B. V. Sinclair (Harrogate): Mr. Lawson, as the other speakers had said, was to be congratulated on his paper.

• N. O. Rasbech. Investigations of the location of *Vibrio fetus* infection in the reproductive organs of the bull. Second International Congress of Physiology and Pathology of Animal Reproduction and of Artificial Insemination. Copenhagen, 1952.

A herd which he had been enquiring into really consisted of two herds, one section being Friesians and the other Guernseys. Both sections used the same field and the same cowshed, the Guernseys being on one side and the Friesians on the other. Apart from the fact that their own breed of bull was kept for each section, they were one herd. *V. foetus* was confirmed in the Friesian herd, but there was no infertility whatever among the Guernseys. From the records apparently this condition had been in existence in the Friesian herd for three years.

Cystic ovaries had been mentioned and he had been to three herds where they were the main complaint. In all three *V. foetus* had now been diagnosed either from mucus samples or the isolation of the organism from the aborted animal.

As regards treatment, three months' rest seemed rather peculiar because Mr. Lawson had made reference to an infected group which had 5·7 services per conception. Usually, cows had broken about three times before a veterinarian was called in. That meant that two months had gone, and if natural service was carried on, three more services, over two months, meant that the cow would be in calf a month earlier than if rested for three months.

How long were the animals infected before agglutinins appeared in the mucus?

Mr. F. Lofthouse (Otley): His experience on this subject had not been as extensive as that of a lot of the previous speakers, because a practitioner had only his own area and was not free lance to roam and collect others' experiences! Practitioners had found, however, that with penicillin they were able to get spectacular results. He might have been lucky in this connection because other organisms might not have been present, but he, too, found cystic ovaries fairly prevalent. At the time he had not thought much about their being related to *V. foetus*, but, looking back, there had been a considerable number in the herds.

In one herd the conception rate had been nil, very nearly. At one time, out of 40 cattle 34 kept returning to the bull and the other six were newly calved or had not been served or were in late pregnancy. That was a good field to start on.

He had treated these animals with 5,000,000 units of penicillin daily for four days. Although that could now be seen as an overdose, at the time he was feeling his way and had to do the best he could. All the heifers that had had any possible contact with the bull were treated; cows and heifers numbered about 70 altogether. Straight away after the treatment natural service was started with the use of the bull. Infertility had disappeared; some of the animals were now just coming to calf for the second time, and there had been no breakdown.

He could not agree with the advocacy of three months' rest. By what had been said, it was apparently beneficial, but what was the position in the north of England where cattle had to be inside for many months? If an outbreak started in late winter and there was no service for three months, with the consequence that the cows calved in March or April, the cost to the farmer would be terrific. Penicillin treatment should be tried immediately in an endeavour to cut the cost for the owner.

With another herd he had dealt with, a similar course had been followed, although the fertility rate was about 50 per cent., but the amount of penicillin given was 5,000,000 units on the first day 4,000 000 on the second day, and subsequently 3,000,000. That had produced just as good results Almost two years had gone by without a breakdown and infertility had disappeared altogether.

The Reply

Mr. Lawson, in reply, said: One thing that appears to have been overlooked by the majority of the speakers was that what had been given were the preliminary results of an experiment that was not yet completed. Considerable incredulity and disbelief had been encountered over the question of the pathogenicity of *V. foetus*, and considering that all the work done on the subject, which was a new field, had been carried out during the last year or so, the results were encouraging. It would be, however, some time yet before a complete picture was obtained.

Several speakers had raised the question of antibiotic treatment. In the literature it had been suggested that the addition of antibiotics to infected semen acted as a complete cure and a group of heifers, Group 4, had been included in the experiment to attempt to establish whether this was so. The results obtained did not suggest that penicillin and streptomycin, *as used in the experiment*, were effective. It must be emphasised that the experiment could only be considered as a pilot and it was hoped to carry out more extensive work on the point. Further, as the experiment progressed, the opportunity was taken to use four "spare" heifers. Two were inseminated with infected semen and two were infected artificially by the introduction of vibrio organisms into the uterus at oestrus. All four became infected. One of the inseminated heifers subsequently proved to be in-calf but the other, and one of the artificially infected heifers, was given an intra-uterine irrigation of 1 000.000 units of streptomycin when in oestrus and again the following day. The other artificially infected heifer was similarly irrigated twice with 1,000,000 units of penicillin. All four were subjected to weekly cultural examinations of the vaginal mucus. From the streptomycin treated heifers vibrios were isolated on several occasions subsequently. The penicillin treated animal proved negative on culture for 19 weeks but vibrios were recovered on the 20th, 21st and 22nd weeks and subsequently. It is thus obvious that further work is necessary before antibiotic treatment can be advocated with any degree of certainty.

Mr. Powley raised an important point when he referred to the necessity of hygiene when the treatment of the bull was being considered. In one herd which had been investigated, two bulls, an old bull and a young one, were obviously infected. The young bull had been used only on heifers and while the herd records showed *when*, some doubts existed as to *how*, he had become infected, until it was found that he had been moved into a loose-box immediately after the old bull had been moved out, and no attempt had been made to remove the bedding or disinfect the box.

With regard to the reliability of the mucus test, it was not suggested that the test was perfect but even with its limitations it was considered that it was the most reliable means of diagnosis available at present. In the experiment which had been described, nearly 100 heifers had been tested at least six times before infections had commenced and in no case had any agglutination been observed. With practice little difficulty would be experienced in collecting sufficient mucus for the test.

Several speakers had asked if there was any difference in the agglutinability of strains or whether there was any variation. These were points about which little was known at present and on which further work would have to be done. At Weybridge all tests were carried out against two antigens, (1) the infecting strain of the experimental animals and (2) a strain isolated from a foetus which on tests on rabbits exhibited good agglutination qualities.

The location of the organism was not known at present. He thought, however, that it would be found that, like trichomoniasis, the location in the bull would probably be in the prepuce and in the cow in the uterus.

He was particularly interested in hearing Mr. Hunter's observations concerning the isolation of vibrios from bull's semen and should be glad to learn his technique. At Weybridge they had found the isolation of the organism to be a very "cnancy" business. No alteration in the semen qualities of infected bulls had been observed.

The question of diagnosing infection in the bull was a difficult one. Agglutination tests of serum and semen against *V. foetus* antigens had met with completely negative results and at the moment the test mating of heifers appeared to be the only practical method of diagnosis. While it appeared likely that a bull might remain infected for years, no evidence was available to indicate how long a female might remain infected or infective. This was a most important point which, it was hoped, would be cleared up as the Weybridge work progressed. The great mass of evidence suggested that transmission was venereal.

Mr. Barrett raised an interesting point in the apparent difference in the pathogenicity of the organism in different herds. He wondered whether Mr. Barrett had gone far enough back in the histories of the herds to which he referred and whether at some time in the past any outbreak of infertility had been experienced. In one herd they knew *V. foetus* was still being recovered from occasional aborted foetuses although it was over 12 years since the herd had suffered from a pronounced wave of infertility.

Mr. Shaw had spoken of the rapid disappearance of the organism in certain materials. They had had similar experiences and wondered whether this might be due to the rapid growth of contaminating organisms with a consequent alteration of the *p*H. They had no concrete evidence on the point at the moment, however.

At Weybridge they had no experience of the pleuropneumonia-like organism referred to by Mr. Hignett. He agreed with Mr. Hignett in that their experimental heifers would be highly susceptible to *V. foetus* infection. Since they came from herds which were believed to be free from infection, this was to be expected. Finally, he would be interested to learn whether Mr. Hignett had isolated the pleuropneumonia-like organism from any of the herds in which he had diagnosed *V. foetus* infection.

The Chairman: In drawing the discussion to a close, he was safe in saying they were unanimous in paying tribute to Mr. Lawson and to Mr. MacKinnon for the very valuable work they were carrying out at Weybridge. Mr. Lawson and Mr. MacKinnon had to be paid a further tribute for the paper they had prepared and upon which there had just been such an interesting discussion.

It was just a little disappointing that not more veterinary practitioners from the field had given their views about herds in the field but, nevertheless, the meeting had been most informative.

Their very best thanks were also due to Mr. Powley for opening the discussion. It was rather difficult for practitioners to speak on such subjects because they perhaps felt a little nervous and shy, but Mr. Powley had opened the discussion very successfully.

The vote of thanks was carried by applause.

ABSTRACTS

Bovine Keratitis Associated with *Moraxella bovis**

Bovine keratitis associated with *Moraxella bovis* or similar gram-negative diplo-bacilli has previously been reported from India, Canada and the U.S.A. Elsewhere, including Great Britain, rickettsia-like organisms have been demonstrated in this condition. [The author does not mention the recent isolation of *Mor. bovis* from an outbreak of bovine keratitis in Scotland. See Watt, J. A. (1951.) *Vet. Rec.* **63.** 98.—*Abstractor.*]

Barner isolated *Mor. bovis* from conjunctival swabs from 92 of 95 clinically affected cattle on a number of different farms in Kansas. Nasal swabs from three of five acute cases were also positive, but blood samples from four acute cases were negative on culture. Conjunctival swabs from 36 normal cattle, 15 normal sheep and 67 sheep with an acute keratitis were culturally negative for *Mor. bovis.*

Microscopical examination of conjunctival scrapings from 36 normal cattle and 23 cattle with acute keratitis showed neither rickettsia-like organisms nor pleuropneumonia-like micro-organisms, but the latter were observed in scrapings from all of 55 sheep with an acute keratitis. An unidentified gram-negative organism was present in scrapings from four of the 15 normal sheep and 23 of the 55 affected sheep. Melanin granules were present in about 75 per cent. of all the scrapings examined.

Pure cultures of *Mor. bovis* failed to cause any reaction when inoculated into the conjunctival sacs of two rabbits, two guinea-pigs and eight sheep, but four calves developed a typical keratitis in six of eight eyes after an incubation period of 15 to 21 days. Two of three adult cattle mixed with these calves also developed keratitis. A year later one calf still harboured the organism, while all seven animals were resistant to reinoculation.

The sensitivity of *Mor. bovis* to various antibiotics was tested *in vitro.* Chloramphenicol and penicillin were the most effective.

The author regards *Mor. bovis* as the causal agent of bovine keratitis as encountered in Kansas.

E. A. G.

* **A Study of *Moraxella bovis* and Its Relation to Bovine Keratitis.** Barner, R. D. (1952.) *Amer. J. vet. Res.* **13.** 132-144. (61 refs.)

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Meniscal Injuries in Dogs*

Since 1937 the author has performed partial or total meniscal extirpations on 60 dogs of 18 different breeds. In 50 cases a medial meniscus was involved, in six cases a lateral one, and in four both cartilages from the same knee (stifle joint) were removed. The lesions consisted of rupture of the disc ; luxation of a whole meniscus which was generally associated with the rupture of one of the lateral ligaments of the joints ; partial or complete rupture of one or other of the crucial ligaments ; abrasions of the cartilages with a tendency to produce a deforming arthritis.

Symptoms were : lameness, with the affected limb carried with some degree of stifle flexion and pointed forward. There was inability to sustain full weight, and often swelling on either side of the patella ligament. Crepitation on flexion and extension was the most typical symptom. In cases of long duration the articular capsule became thickened and there was pronounced muscle atrophy of the limb. With tearing of the crucial ligaments there was excessive joint mobility and with rupture of either of the lateral ligaments of the joint, invariably the internal, there was corresponding increased lateral movement.

Diagnosis was based on the history of injury, impaired mobility and crepitation. In some cases radiography was of assistance, but, in the words of the author, " an absolutely definite diagnosis is often obtained only at the arthrotomy."

Treatment : Prolonged rest having proved ineffectual in the majority of cases of meniscal injuries, it is now the author's practice to extirpate part of the diseased disc. In the early days the entire cartilage was removed, but more recently the operation has been conducted on conservative lines and entails the removal of the anterior half plus any loose portions of the posterior half. It has been found that when a meniscus is wholly or partly extirpated a new one, composed of connective tissue, is formed in its place differing only slightly in shape and consistency from the original.

Operation technique : Under morphine narcosis and epidural anaesthesia the dog is placed in lateral recumbency with the stifle joint partly flexed. A crescentic incision is made through the skin, close to the straight patella ligament, from the patella to the internal lateral ligament. This incision is made on either the inside or the outside of the leg corresponding to the meniscus affected. The *fascia lata* is next incised together with its underlying adipose tissue. After attention to haemostasis the joint capsule is opened by means of scissors. This is usually accompanied by profuse haemorrhage which is checked by a pressure pad. The anterior parts of both discs can now be seen along with the internal lateral ligament of the joint, and the anterior crucial ligament. If the medial disc is diseased its anterior crucial ligament is first detached. Then the anterior half is separated from the capsule and the internal lateral ligament of the joint, and cut off level with the latter. If the entire disc is torn off the posterior half is removed. This means making the incision into the joint behind the lateral ligament. To enable this to be done the skin incision has to be extended backwards. Profuse bleeding, which may be difficult to arrest, follows detachment of the disc. It does not impair healing, however. Cod-liver oil is introduced into the joint and the capsule is closed with Lembert sutures of catgut, taking care not to perforate the synovial membrane with the needle. Rupture of the internal lateral ligament is repaired with 0·20 mm. non-corrosive wire, and the medial aspect of the joint is supported further by screws into femur and tibia connected by silver wire. The fascial wound is closed with catgu and the skin with metal sutures. The wound is bandaged and the limb is placed in a Thomas-Schroeder splint. The splint is kept on the limb for one week, but on discharge from hospital the patient has to be kept quiet for two to three months. It is not unusual for the dog to be lame for from one to three months following operation. Two dogs were destroyed because of a purulent arthritis of the stifle joint and one died as a result of acute nephrosis.

C. F.

* **Meniscal Injuries in Dogs.** Nilsson, F. (1949.) *N. Amer. Vet.* **30.** 509-516.

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Internal Bacterial Taints of Cured Pork Legs*

The term " bacon gammon " is used in this article for legs of pork into which brine has been injected during curing at the rate of 5 per cent. or more, by weight, as is usual in tank curing of bacon. The word " ham " is reserved for the dry-cured product into which no brine is injected. [Gammons are cured attached to the side of pork (a Wiltshire

* **Internal Bacterial Taints of Cured Pork Legs. (Bone Taint or Souring.)** Ingram, M. (1952.) *J. Hyg.* **50.** 165-181.

side) whilst hams are normally removed from the side of pork before curing. Gammons, being cut from the side of bacon, exhibit a straight c t surface of raw meat whilst York hams show a rounded edge.—*Abstractor's note.*]

Deep bacteriological samples were obtained from leg joints by searing a flat surface and cutting through the leg with roughly sterile instruments, after the external surface had been cleaned and disinfected with Lysol. The 5-gramme samples were dissected aseptically from the seared gastrocnemius muscle, which has a relatively high *p*H, and is always involved in "taint."

The average *p*H of different leg muscles in sound ham is as follows :—

Gastrocnemius	Semitendinosus	Sartorius	Gracilis
6·23	6·15	6·13	5·84

The salt content was determined by electrometric titration of the chloride in a hot aqueous extract, but as the effective factor is the concentration of the NaCl in watery solution in the meat, the salt content is expressed as the percentage of the water content of the muscle. This latter was determined by drying a minced sample for 96 hours at 103° C. Values ranged from 65 to 75 per cent. of fresh weight.

The *p*H was found by snipping 10 grammes of muscle into 20 c.c. water, adding 0·5 ml. of $CHCl_3$, allowing to stand more than two hours and measuring with a glass electrode at 15° C. ; quantities and times were not critical. With the psoas major the gross *p*H of such samples is practically the same for different parts of the muscle.

Sound hams are almost sterile internally, whilst enormous numbers of bacteria are found in the spoiled parts of tainted hams. The typical flora consists of Clostridia or faecal streptococci, or both. Staining reveals large gram-positive rods and/or large ovoid gram-positive diplococci. Gram-negative rods may be present, but rarely predominate. Some of the species isolated from the femur marrow and gastrocnemius of tainted hams were probably of faecal origin. (Tables are given showing the types of organisms, growth temperatures and reactions.)

A characteristic of the bacterial flora of tainted hams is its limited distribution which is obvious from the texture, colour, smell and taste of the flesh at different places. The bacteria are usually numerous n a few muscles near the bone. These may be related to the low acidity of the muscles, and their deep-seated position makes the penetration of salt slow. They are also the muscles which remain warm longest. Infection may occur from the bone outwards, as in some hams examined bacteria were found only in the marrow. Observations in New Zealand suggest that beef bone taint begins in the blood vessels of the femur marrow and extends into the adjacent muscles.

In gammons, the flora differs markedly in that the bacteria here have an optimum temperature of 25° C. instead of 37° C. They tolerate a relatively high concentration of NaCl, reduce nitrate, and are mainly micrococci. Several species may occur together and many do not correspond closely with well-recognised species.

Bacteria are present in all gammons without necessarily showing taint, and spores of Clostridia and bacilli are often present in small numbers in the curing brine. In gammons where little salt has been injected, the flora is mainly "faecal," but if the injected brine has thoroughly penetrated the tissues the flora is almost wholly halophilic.

The probable difference between the flora of "hams" and "gammons" arises because the ham flora consists of bacteria occurring naturally in the animal body, whilst the gammon flora is formed largely of bacteria introduced from external sources. The nature of the "taint" also differs. In hams the taint often commences before curing is begun, and ham taint is usually putrid. In gammons taint develops gradually and may not be evident for some time after curing, being inclined to be cheesy and rancid.

For long storage it would seem wise to sterilise the brine used for injection, and the addition of acid might be beneficial.

D. J. A.

REVIEW

[Introduction to Veterinary Therapeutics. By George F. Boddie, B.Sc., M.R.C.V.S., F.R.S.E. (October, 1952.) Published by Oliver and Boyd, Ltd., Tweeddale Court, Edinburgh. Price 15s. net.]

As is pointed out by the author in his preface, this book is a new departure in the literature of veterinary therapeutics and it is a little difficult accurately to assess its value in the relatively short time available to a reviewer to form an opinion.

None will disagree with the author in his attempt to summarise and thus lighten the burden on students of the mass of factual detail required to be absorbed for examination purposes. It is emphasised that each section is illustrated by selected drugs—is there perhaps the danger that readers may feel that these are *recommended* drugs and therefore not pursue investigations into the clinical use of drugs not mentioned here ?

There is no doubt at all that the book forms a most handy and concise source of reference and a glance at the section devoted to the particular system under consideration will give information regarding therapeutic effects which may be expected from certain drugs and their feasibility in practice—an important point.

The style, as befits a teacher of the author's eminence, at times is dogmatic. May we query one such statement—viz., that diabetes mellitus occurs only in the dog ?

Perhaps we may do something that is not intended and consider this book in the light of the anticipated publication of a British Veterinary Codex ; when the latter is accomplished, it and Professor Boddie's book will form a combination invaluable to students, practitioners, and teachers—the detail afforded by the B. Vet. C. will serve admirably to clothe the very fine framework presented to us in "Veterinary Therapeutics."

Weekly Wisdom

Quality in art and literature is created by those who are not content with what will pass muster or win applause, but are driven by the ambition for perfection. It is perhaps an unattainable ambition and one who has it is never satisfied, but he belongs to the select company of those who create values for human culture and keep them alive.—Dr. W. R. Matthews, Dean of St. Paul's.

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Copenhagen is becoming the main animal disease and nutrition Conference centre of Europe. Ways of improving animal feeding on the farms of the Continent were discussed by experts at Copenhagen a short while ago. The meeting, jointly sponsored by the Danish Ministry of Agriculture and the Organisation for European Economic Co-operation, discussed how best to reduce the present very considerable losses to Europe's production through under feeding and defective feeding of farm animals.

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The Metropolitan Counties Branch of the British Medical Association is celebrating its centenary during this session, and a centenary ball will be held at B.M.A. House on Thursday, January 8th, 1953, the proceeds of which will be divided among medical charities.

Quarterly Meeting of Council, B.V.A.

SUMMARY OF PROCEEDINGS

An excellent attendance at the first quarterly meeting of Council augured well for the Association's year 1952-53. It was, therefore, the more to be regretted that relatively early in the proceedings of this, his initial London meeting in the chair, our new President, Mr. Alistair M. Graham, at the Connaught Rooms on Friday, November 7th, on the receipt of a message from the Registrar, was called upon to announce the sudden death of Dr. J. T. Edwards—a valued member of Council, a veterinary scientist of great repute and the first editor of *The Veterinary Record* on its acquirement by the Association. Council paid heartfelt tribute in a few minutes' silence.

At the outset the President had extended a warm welcome to new members of Council, but had included all present in his expression of the hope that through their agency an adequate account of its discussions and findings would reach the constituent Branches and Divisions. Arising from the minutes of the meeting at Harrogate, he then called on Dr. Montgomerie (Chairman) to present the report of the special committee there appointed to prepare evidence for the Departmental Committee of enquiry into the efficacy of the measures taken in this country to combat foot-and-mouth disease. The special committee had presented a memorandum, and had also given oral evidence on November 4th: the former would be published in *The Veterinary Record*. The committee was indebted to Professor Glover for effectual liaison with the Royal College in this matter. The President paid a heartily applauded tribute to Dr. Montgomerie both for the major part he took in drawing up the memorandum of evidence and acting as the Association's chief spokesman before the Departmental Committee. Another, and a most pleasant echo of our happy stay in Yorkshire came through the medium of "Correspondence" in an expression by Mr. H. B. Allan, President of the local Division, of the fact that they "thoroughly appreciated the honour of having the Congress in the county"—a mutual sentiment indeed! Next came the welcome announcement by the Secretary that at 3,876 the membership had reached a new record.

Council then settled down to the main business—consideration of committee reports. The desire of the Association to keep members of the profession better informed concerning outbreaks of foot-and-mouth disease has been discussed by representatives of the Parliamentary and Public Relations Committee with the Chief Veterinary Officer and other personnel of the Animal Health Division and this also has been emphasised in the memorandum of evidence to which reference is made above. Measures to restrain cruelty to animals figured largely in this report: the efficacy of the Docking of Horses Act is in question; the draft (R.S.P.C.A.) Bill to prohibit the use of cruel poisons is under consideration, and as we have announced, Sir Frank Ware is the veterinary member now added to the Advisory Committee under the Cruelty to Animals Act, 1876.

The report of the Veterinary State Medicine Committee referred to progress made in discussions with the Ministry of Food on improved arrangements at slaughterhouses for dealing with casualty animals. As a by-product of these exchanges some progress has been made in implementing the suggestion that veterinary surgeons should have permission to remove reasonable material from slaughterhouses for pathological investigation. In connection with the Government's committee of enquiry into the slaughter of horses, a sub-committee is to draw up evidence to be presented, following decision to accept the invitation to do so, extended to the Association by the Ministry of Food.

The question of the use of antibiotics in feeding-stuffs is being examined by a panel of committee members, with a view to the publication of information in the Association's journal as required, the committee being of the opinion that antibiotics should be prescribed in feeding-stuffs for animals, only in the treatment of specific disease conditions and under the direction of a veterinary surgeon. The rapid spread of anthrax was a matter of concern to the Council, which endorsed a suggestion that the possibility of spread of infection through animal feeding-stuffs or containers, or both, with particular reference to anthrax and swine erysipelas, should be taken up with the Ministry of Agriculture.

The Organising Committee has appointed B.V.A. representatives to serve on the Standing Joint Committee with the Royal College to consider matters relating to the proposals made in the report of the Champion Committee on Licences under Section 7 of the Veterinary Surgeons Act, 1948. This joint committee will deal with the points raised in resolutions relating to the report now being received from Divisions of the Association. The General Purposes and Finance Committee, amongst its multifarious duties, has been enquiring into the matter of new premises for the Association, which has come to the fore in consequence of the expansionist requirements of the University of London. Proposals are afoot for a memorial prize to the dynamic President whose initiative brought into being the Association's scheme of survey into the diseases of animals, and it is sad indeed that death has overtaken Dr. Edwards, whose conception it was that a Steele-Bodger memorial should be established.

It may be noted from the report of this committee that the changes in Divisional representation on Council, already intimated in these columns, have been adopted by the annual general meeting at Harrogate, and will begin to operate with the appointment of representatives of Divisions to serve on the Council for the year 1953-54.

The report included notification of the intention to issue the statement, published in our issue of November 15th, intimating the arrangement agreed between the Pharmaceutical Society of Great Britain, the R.C.V.S. and the Association, whereby the members of the Society will be recommended not to supply certain products for animal treatment, or associate themselves directly or indirectly with such supplies, except to or on the prescription of a veterinary surgeon or veterinary practitioner.

This committee reported having given consideration to a letter from a member suggesting, *inter alia*, the arrangement of sectional meetings at the Congress in order to provide alternative programmes in the morning and afternoon of each day, and expressing the opinion that the attendance at Congress would benefit if the scientific side had a greater appeal. These suggestions, of course, have been passed to the Provisional Committee for the 1953 Congress.

A proposal by the Hon. Secretary for the amendment of Article 25 was accepted by the Council in the following form:—

"Subject to Article 27 hereof any 20 or more members may associate themselves together and apply to the Council for approval to form a Division of the Association on the grounds of geographical location or of sectional professional interest, and any number of Divisions may group themselves together and apply to the Council for approval as a Branch of the Association."

The officers of the Association, and other representatives selected by them, are to enter into discussion with societies and others interested, in investigating the present methods of electrical euthanasia.

In the light of a discussion by the General Purposes and Finance Committee the Editorial Committee was asked to reconsider its proposal that the issue of the Supplement to *The Veterinary Record* be discontinued.

UFAW AND BULL-FIGHTING

The Universities Federation for Animal Welfare devotes the current number of its publication, the *UFAW Courier*, to the subject of bull-fighting. The introductory article by the Director of UFAW gives reasons why the subject concerns us in Britain. The relation of bull-fighting to ancient Roman entertainments (gladiatorial shows, the throwing of Christians to wild beasts and so on) is brought out in an historical article by a distinguished classical scholar, Professor E. H. Warmington. Eye-witness accounts of modern bull-fights are given by a veterinary surgeon and an agricultural student. A note on the recent changes in the French law on the subject has been contributed by a distinguished French lawyer.

UFAW is at the same time publishing the second edition of *Kind Killing*. This pamphlet gives practical instructions on the most humane ways of killing various species of captive animals (dogs, cats, farm stock, rats, tortoises, poultry, etc.) when the killing has to be done by a layman; methods available only to veterinary surgeons are omitted.

QUESTIONS IN PARLIAMENT

Slaughtermen

Captain Duncan (November 18th) asked the Minister of Labour what steps he is taking to encourage the entry into the trade of slaughterhousemen in the increased numbers likely to be necessary under Her Majesty's Government's policy of moderate concentration of slaughterhouses in Great Britain; and what arrangement he is making for training such men.

Sir W. Monckton: While it is too early to say how the new policy for siting slaughterhouses will affect the number of slaughtermen required, the Joint Industrial Council for the industry has recently drawn up an apprenticeship scheme for young workers entering the industry.

Captain Duncan: Arising out of that reply, is my right hon. and learned Friend aware that the National Farmers' Unions of England and Scotland are developing a tentative marketing scheme to take over from the Ministry of Food; that two prerequisites of that are sufficient slaughterhouses and sufficient slaughtermen; and that there is a shortage of both at the present moment. Will my right hon. and learned Friend deal with the slaughterhouse question?

Sir W. Monckton: So far as the slaughterhouse question is concerned, the policy statement already made in this House does not involve a very large reduction in the number of slaughter points now being used by the Ministry of Food. But it does mean that there will be a considerable reduction on the pre-war figure of the number of slaughterhouses. It is too soon at present to know whether we shall need more than the scheme of which I spoke.

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Tuberculosis (Milch Cows)

Mr. Hastings (November 20th) asked the Minister of Agriculture what percentage of the milch cows in Great Britain have been shown, by test, to be now free from tuberculosis and how this figure compares with corresponding figures for last year and the year before.

Sir T. Dugdale: I regret that the figures which the hon. Member asks for are not available, but about 53 per cent. of the milk now sold in Great Britain comes from cows that have passed an official tuberculin test, compared with about 46 per cent. a year ago and 38 per cent. two years ago.

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Fowl Pest Order

Mr. G. Williams (November 20th) asked the Minister of Agriculture if he has considered abolishing the Fowl Pest Order, which does not allow less than 25 head of poultry to be brought to market in one lot, in view of the fact that fowl pest is not as prevalent as it was.

Sir T. Dugdale: I regret that it is not yet possible to withdraw the Order to which my hon. Friend refers. There have been over 200 outbreaks of fowl pest this year, of which 65 occurred in the last three months, and we cannot yet relax our precautions.

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Sheep-worrying

Mr. G. Williams (November 20th) asked the Minister of Agriculture what action he is contemplating to deal with owners of dogs which worry sheep.

Sir T. Dugdale: Civil proceedings for damages can be taken against the owners of dogs that injure sheep. Such dogs may be dealt with as dangerous dogs under the Dogs Acts and ordered by a court to be kept under proper control or destroyed. I do not think that there is any need to provide additional methods for dealing with owners of dogs that worry sheep and my recent consideration of the problem has been directed rather to securing that dogs are kept under control in areas where they might cause harm to livestock.

Commander Maitland asked the Minister of Agriculture what action he proposes to take to reduce effectively the number of cases of sheep-worrying by dogs.

Sir T. Dugdale: Until it is possible to introduce new legislation there is very little more that can be done by the Government to reduce sheep-worrying, but I intend to continue to try to bring home to dog owners the importance of preventing their dogs from worrying livestock. I am glad to say that I have been promised the full support of a number of the animal welfare societies in these efforts.

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Toxic Sprays (Research)

Mr. J. Morrison (November 20th) asked the Minister of Agriculture which official institutes are experimenting in regard to the particular effect of toxic sprays and their danger to animal and insect life in regard to the long-term effects on agriculture.

Sir T. Dugdale: Research on the long-term effects of the use of toxic sprays in agriculture is being carried out at the East Malling Research Station. The Imperial College of Science is also engaged on one aspect of this problem with the aid of grants from the agricultural Research Council and the Nature Conservancy. Much research on shorter term aspects is being done by research institutes, universities and chemical firms, including a search for insecticides less toxic to animal life than those now in use. This latter research will eventually contribute towards a proper assessment of long-term effects.

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Cattle Exports (Quarantine Stations)

Mr. Hurd (November 20th) asked the Minister of Agriculture what steps are being taken to increase the capacity of the cattle quarantine stations so as to facilitate the export of pedigree stock to the Dominions and other overseas countries; and how many animals are at present awaiting shipment.

Sir T. Dugdale: I have arranged for an extension to the Glasgow Quarantine Station to be put in hand, if it is still necessary, when we know the intentions of the Canadian Government regarding the resumption of livestock imports from this country. The quarantine facilities at the other two stations in London and Liverpool are adequate. I understand from the Livestock Export Group that about 900 cattle and 60 head of small stock are at present awaiting shipment.

NOTES AND NEWS

Diary of Events

Dec. 3rd.—Meeting of the Lancashire Division, B.V.A., in the Veterinary Hospital, Liverpool, 2.30 p.m.

Dec. 4th.—Meeting of the Central Division, B.V.A., at the Royal Veterinary College, N.W.1, 6 p.m.

Dec. 4th.—Annual Dinner-Dance of the North of England Division, B.V.A., in aid of the V.V.B.F.

Dec. 5th.—Meeting of the Yorkshire Division, B.V.A., at Leeds (Hotel Metropole), 2.30 p.m.

Dec. 9th.—Technical Development Committee, B.V.A. (to discuss Sheep Diseases Report), 11 a.m.

Dec. 10th.—Meeting of the Editorial Executive, B.V.A., 2.30 p.m.

Dec. 10th.—Annual General Meeting of the Scottish Branch, B.V.A., in the Royal (Dick) School of Veterinary Studies, Edinburgh, 2.30 p.m.

Dec. 10th.—Annual General Meeting of the Farmers' Club, Royal Empire Society Hall, Craven Street, London, 2.15 p.m. (Mr. Geo. N. Gould, M.R.C.V.S.: Problems of Animal Health Associated with Grassland and the Feeding of Fodder Crops.)

Dec. 10th.—Meeting of the Southern Counties Division, B.V.A., at Winchester (Royal Hotel), 6.30 p.m.

Dec. 10th.—Technical Development Committee, B.V.A. (Ordinary Meeting), 10 a.m.

Dec. 12th.—Winter General Meeting of the North of England Division, B.V.A., at King's College, Newcastle-upon-Tyne.

Dec. 12th.—Meeting of the Midland Counties Division, B.V.A., at the Birmingham Medical Institute, 2 p.m.

Dec. 12th.—Annual Dinner and Dance, North Wales Division, B.V.A., at Llandudno. (See Notice.)

Dec. 17th.—Meeting of the Section of Comparative Medicine Royal Society of Medicine, at 1, Wimpole Street, W.1., 5 p.m.

Dec. 19th.—Meeting of the Sussex Division, B.V.A., at Brighton (The Old Ship Hotel), 2.30 p.m.

Jan. 9th, 1953.—Dumfries and Galloway Division, B.V.A., Ladies' Guild: Annual Dance in aid of the V.V.B.F., at Dumfries (Cairndale Hotel). (See Notice.)

R.C.V.S. Examinations

Membership Examinations.—Written: Thursday and Friday, December 4th and 5th, 1952. Orals and Practicals: Commencing Monday, December 8th, 1952.

COUNCIL AND COMMITTEE MEETINGS OF THE B.V.A.

The following arrangements for the Council and Committee meetings of the B.V.A. in January, April and July of 1953, have been made by Council B.V.A.:—

January 14th, 15th and 16th in London.
April 29th, 30th and May 1st in Edinburgh.
July 29th, 30th and 31st in London.

The times of the various meetings will be published in due course.

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Second Grassland Conference, B.V.A.

METABOLIC DISORDERS AND OTHER PROBLEMS RELATED TO GRASSLAND AND FODDER CROPS AND INNOVATIONS IN ANIMAL HUSBANDRY

On the Thursday and Friday of last week, in the same hospitable meeting place as four years ago—the auditorium of the Wellcome Foundation in Euston Road, London, N.W.1—the Association, on the broader basis indicated above, resumed its consideration of matters pertaining to grassland, upon the development of which, as those present were reminded by the opening speaker, the future progress of British agriculture depends. He was Mr. G. N.. Gould, of Southampton, and at the outset of the proceedings the President (Mr. A. M. Graham), who was in the Chair throughout and who was supported by his fellow officers, by Mr. Ritchie (Chief Veterinary Officer) and by Dr. Montgomerie, of the host institution, spoke of him as the moving spirit of the venture. It was Mr. Gould who, with the encouragement of the Technical Development Committee (of which he is Chairman) had mooted the idea of the Conference and carried the proposal into effect—officially sponsored and organised by the B.V.A. On this occasion, however, the conference, as the President said, was of a domestic nature, this restriction being prompted by a certain modesty; those from collateral spheres to whom this conference was not now open, but who were interested in the problems under discussion, would be welcomed to a further conference did the present deliberations reveal such marked progress as would justify such a fixture.

Very appropriately, then, Mr. Gould opened the programme by discussing grassland management factors and their relation to problems arising. The very diverse farming conditions existing throughout the country contributed to the slow progress made: lack of capital and equipment and, in particular, lack of experience of the more highly organised, discriminating and individual management demanded by the ley sward, if full advantage was to be taken of the improved nutrition made available. The impact of environment on the incidence of many diseases prevalent in our stock had falsified the disease elimination predictions confidently made in the initial stages of the grassland development programme. Its problems were likely to be intensified in the absence of a clear understanding of the proper and efficient use of the grass crop, whether consumed *in situ* or as the conserved product. Mr. Gould then pointed to some of the factors concerned in the establishment and future activity of the ley and to some aspects of animal behaviour and ruminal digestion in their relation to the subject under discussion; leaving it to his successors to deal with metabolic disorders and other problems related to grassland and other crops which are occurring throughout Great Britain.

Dr. Barron, of Reading, in a composite paper, took for his first subject winter scours, for the treatment of which, he said, copper sulphate was almost a specific: 1 to 2 oz. in the form of a drench, at once, or 1 oz. dissolved in a small amount of water poured on the ration and given on two consecutive days: one subsequent speaker thought a dram twice a day an adequate dosage rate. Enterotoxaemias were typified by the group of enteric infections encountered in sheep and associated with variants of *Cl. welchii*. Having reviewed the findings in the literature, Dr. Barron added: From these it is clear that no exact recommendations regarding the management as distinct from therapeutic measures can be made to the flock-master which will provide a complete guarantee against an outbreak of the enterotoxaemias . . . . caution should be exercised in moving flocks, i.e., the level of nutrition should remain as uniform as possible.

Mr. J. O. L. King, of Liverpool (opener) agreed with Mr. Gould that widespread pasture improvement had increased stock-food production, but the fibre content had been lowered, reducing peristaltic activity. That appeared to predispose to certain diseases, such as the enterotoxaemias of sheep. The third topic treated by Dr. Barron concerned the fluctuations in fat and solids-not-fat in milk, concerning which the existence of legal standards (three per cent. and 8·5 per cent. minimum respectively) caused any tendency to fall below them to be viewed with apprehension. Seasonal, breed and dietary factors were specified as influencing variations. Unrestricted grazing of young spring pasture of low fibre and total protein content would have a depressing effect upon the fat if the ration was not supplemented in any way to maintain the fibre level. One speaker pointed out "an unusual legal position in British law," in that it was quite legal to sell milk of any composition so long as it could be proved that it was as it came from the cow, but the farmer was presumed to be guilty of selling adulterated milk unless he could prove his innocence.

"The milk fever syndrome" was one of the subjects dealt with "from the point of view of the practitioner" by Mr. J. B. White of Salisbury. This disorder was not treated with the same urgency as in former days "because the idea is prevalent that it is only necessary to give calcium intravenously and the cow will recover." Yet as these cases often occurred when the cow was feeding a heavy grass flush, the probability was increased of cases of mixed origin, rather than of straight hypocalcaemia: he had a liking for the mixed injection containing hypophosphites. Early treatment—and detection—was all important also in hypomagnesaemia. $MgSo_4$ gave quite good results, but for acute cases he much preferred CaMgP mixture given intravenously. Well-made hay, with maize or dredge corn, was a good means of preventive husbandry. Ketosis continued to present a problem. Bicarbonates were of value, but glycerine was superior and glucose gave relief when given intravenously, with vitamin B_1 a serviceable agent. Mr. W. J. B. Robson, of Lawrencekirk (opening) pleaded for the seasonal chemical analysis of grass, also saying: "I feel that if we knew more about the stimulation of the udder, we should know more about the actual cause of the onset of milk fever." Mr. A. J. Wright did not think that the actual number of milk fever cases had increased during the last ten years, but the atypical cases had done so since the advent of grass conservation processes.

As reflecting one aspect of the modern study of animal husbandry, of great value was the contribution made by Mr. P. G. Hignett, of the Wellcome Veterinary Research Station, Frant, on "The significance of some major and minor mineral elements, and factors affecting their metabolism." Recent changes in feeding had tended rather to increase than to decrease the calcium intake of our farm stock, so that one would not expect to find lack of dietary calcium *per se* widespread in large farm animals at the present time. Those changes in farm management responsible, also had tended to cause a relative or absolute reduction in phosphorus intake, with the result that phosphorus deficiency, conditioned or actual and varying in degree, had become of greater significance in this country. In no case, however, was it necessary to advise the abandonment of any of those improved farming techniques which are helping so materially to increase the output of farm produce. In the course of his review, this speaker said that hypocuprosis (a herd problem and restricted to certain areas) responded well to the oral administration of 1 to 2 g. copper sulphate per day, and he emphasised that before embarking on the intravenous use of a copper sulphate solution (recently introduced by Weybridge workers) the existence of a copper deficiency must be proved, as too large a dose would lead to death. Mr. A. Shand (Weybridge) presented a useful little paper on the goitrogenic factor in kale. Kale was a crop that was being encouraged and if it could contain large amounts of goitrogen in some years, it was well to remember that such food might be dangerous if fed in excess to pregnant ewes, although, on the other hand, it might be a help in fattening animals for slaughter. In opening the discussion, Mr. J. G. Murray, of Ledbury, emphasised the need for the preservation of a correct Ca/P ratio in breeding cattle; the essayist, however, thought that, speaking generally, its importance was overstressed, although it did become significant if the phosphorus content of the feed was low. The day's proceedings ended with the reading and discussion of Mr.

W. P. Blount's paper—with refreshing embellishment of the text—on problems of poultry husbandry associated with hen batteries, deep litter and folds. Both the opener (Miss W. M. Brancker, of Sutton Coldfield) and Mr. Barker vigorously contested the suggestion that the veterinary surgeon in general practice took little or no interest in the poultry husbandry and disease.

"The specialist poultry farmer leads the way," said Dr. Blount, "and the progressive general farmer then attempts to utilise his stock on similar lines, but in doing so he may need considerable guidance as to the best methods to adopt. This is where the veterinary surgeon can play an important part both in relation to nutrition and disease control." Support for the use of hen batteries followed: disease control was self operating, culling was simplified and egg production was high; moreover, allegations of cruelty had no foundation in fact—for reasons given. Discussion of problems related to the hen battery system was followed by that of those relating to deep litter houses and folds: hen yards—a later development—were also described.

The 200 or so ticket holders again took their seats in strength on the second day of the conference, when the proceedings opened with another hydra-headed paper: that by Dr. H. G. Lamont, of Belfast, on urticaria; photosensitisation; blue nose in horses and oedema of the bowel in pigs. The stimulus thus given to the study of the allergic conditions was welcomed both by the opener (Mr. W. B. Forrest, Blandford) and Mr. W. A. Pool, of Weybridge; the debate, however, centred largely round oedema disease, which was so helpfully discussed by Mr. Timoney at our Cardiff Congress in 1950. Dr. Lamont reported that in Belfast they had succeeded, as had Mr. Timoney, in transmitting the condition. Experimental findings suggested the presence of a toxic factor which might be of bacterial origin, or possibly a degradation product of protein metabolism. In their hands most of the suggested methods of treatment had been disappointing. The original Epsom salts treatment was still used, purgatives of the ethyl choline type were recommended by Mr. R. H. Smythe, and success was claimed for vitamin B_1 injections for the sulpha drugs and for the antihistaminics, with or without penicillin. The feeding of fodder beet and folding of pigs on green crops was usefully discussed by Mr. J. S. S. Inglis, of Glasgow, with many helpful indications and some reservations. In his opinion, perhaps the most useful of all the pig folding systems was that where the sow and litter were provided with a tightly constructed, well insulated, movable A-shaped ark, and access to a field. Mr. E. C. Morris (Winchester) and Mr. J. A. J. Venn (Bristol) opened the discussion.

Regarding this second meeting as the opportunity of presenting an interim report of progress made since his exposition in 1948, Dr E. L. Taylor, of Weybridge, saw his theme "Grassland management and parasitism" essentially as the study of a great factor in the vital business of providing a breathing space "to allow us the chance of making some changes in this country before world shortage (of food, due to the rapid increase in the human population) becomes acute." Increasing awareness of loss from sub-clinical disease, in the causation of which parasitism played a leading role, was a notable advance. Consideration of the host parasite relationship was followed by a typically arresting reference not (as might have been anticipated) to the danger of high concentration of stock on pastures, but to a poor farm, in an exposed position, which had been improved to an extraordinary extent by increasing the concentration of sheep, yet at the end of a long (winter) period of grazing on pastures which virtually had become bare, the stock were in good condition and were carrying only a light worm infestation. "If one ordinary farm can do it, why not at least a proportion of other farms in other parts of the country?" The following factors might be involved in the freedom from parasitic worms experienced on this farm: (1) Being exposed very early to a heavy infection the young lambs developed a resistance at an early age; (2) The older sheep ate down the pasture so close that they collected nearly all of the infective larvae and destroyed them, so that few were left to infest the lambs; and (3) The bare pastures afforded no protection to the faeces of the grazing animals, so that they tended to dry out, the pre-infective larvae being destroyed.

Fog fever was included in the range of this paper. In this connection, "the confusion between fog fever and invasion by parasitic worms still remains to be classified," but work by Michel at Weybridge gave a clear indication that infection with *Dictyocaulus* was often associated with fog fever syndrome; indeed, at that centre they were leaning more and more towards the idea that fog fever and the effects of parasitic infestation were one and the same, but Michel was of the opinion that it was essential for the infection to be acquired suddenly and that the gradual picking-up of larvae would not produce the symptoms. Mr. J. W. Bruford, of Sevenoaks, opened the discussion and he and subsequent speakers (notably Mr. Barker) found fruitful themes in fog fever and the association of parasitism with sub-clinical disease. The latter took the opportunity to convey to the President, Council, and Members of the B.V.A. the goodwill of the Australian Veterinary Association and of the Australian Veterinary Services Council.

Mr. J. J. Inglis, of Glasgow, dealt with the relationship of feeding-stuffs to the rearing of calves, reciting the results of his own investigations (on the farms visited by him), into the effects of experimental rations fed to calves suffering from scour and often exhibiting symptoms of meningitis. Further experiments were in hand in an endeavour to establish some responsible factor in the milk related to certain foods with a high protein content. Mr. J. M. Ingram's opening was read by Mr. Gould. Mr. A. Gregor, of Wool, Dorset, presented a study of rye grass staggers, rape poisoning, feeding of beet tops, dietetic haematuria and selenium poisoning, this being supplemented by Dr. W. S. Gordon in an opening in which he illustrated, *inter alia*, the attempts of animals to adjust their metabolism to varying conditions of pasture at Compton.

The final paper of the conference reviewed the still absorbing, very practical, subject of bloat. It was presented by Mr. D. W. Menzies, of Langford, Bristol, who pointed to general acceptance of the fact that the acute type of bloat had increased markedly since so much land had come under the plough and been sown down to new leys, and wider use made of fodder crops, such as kale. Whether high incidence could be correlated with a high protein, low fibre diet could not yet be established, and further research into the type of fibre, *i.e.*, the proportions of lignin, cellulose and hemicellulose, present in the herbage, might prove to be a profitable line of enquiry. It appeared that, on certain farms, seeds mixtures containing fescue reduced the incidence of the condition, but much more extensive trials remained to be done on a variety of soils before it could be recommended for universal use. In 1950 Bloat Investigation Groups had been formed in all the N.A.A.S. provinces and the results since recorded were surveyed by the speaker, who concluded: "Whatever the cause or causes of bloat, it appears likely to continue to occur under existing methods of crop husbandry. Our salvation, at present, appears to be in improved techniques of grazing management or in seeds mixtures so adjusted as to prevent a preponderance of clover." Opening this discussion, Mr. H. F. Hebeler, of Langport, Somerset, and the Hon. Secretary of the Association, expressed his sense of the importance of a continuance of the bloat survey. He thought there had been over simplification of many seeds mixtures, while the modern practice of heavy liming might be a contributory cause, it having been recorded that grazing of such land increased the rate of fermentation in the rumen. Roughage had to be fed to counteract the effect of heavy grazing on clover. Surgically, it was important to distinguish between tympany and frothy bloat. As to medicinal treatment, in his experience there had been no improvement on the old formalin or turpentine and the other antizymotics.

Possibly because now there was time in hand, this discussion was taken up briskly from all parts of the hall, as befitted a topic of such universal experience and appeal. Eventually, following the essayist's reply, the Chairman called on Mr. Ritchie to sum up—a difficult task indeed, but one which the Chief Veterinary Officer achieved most effectively and with a masterly economy of words, stressing the point that the subject of grassland management was essentially a "veterinary surgeon's one," for it was he who had to deal with the animal affected thereby. He suggested that, not only should the proceedings be published,

but that the Technical Development Committee of the Association should study all that had transpired in the last two days and consider just what they had got in the matter of firm knowledge of the matters discussed, and possibly the institution of team work for its further prosecution.

Heartily accorded votes of thanks followed: to the readers, openers and ensuing speakers; to Mr. Gould and his Committee for organising such a successful conference; to the Wellcome Foundation (to be transmitted through Dr. Montgomerie) for the admirable facilities offered, and to Miss Rosa Smith, Secretary of the Technical Development Committee, to whose arduous and successful work in making arrangements for the conference special reference was made by the President.

So ended what in its very general aspect perhaps might be regarded as a "repeat performance"—one which, despite self-imposed restrictions, achieved the exceptional result of surpassing the highly successful original event. The discussions, with some mechanical aid, were admirably controlled from the Chair. The fact that the twelve-paper programme had to be dealt with in the short period of four sessions inevitably lent a "high pressure" character to the debates. Though undeniably disadvantageous from the point of view of the provision of supplementary information and the adequate ventilation of views, this at least constituted a testimony to the interest inherent in the subjects chosen and to the success of the essayists in fulfilling their primary task of educing both argument and further knowledge.

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PERSONAL

Births.—Gray.—On November 9th, 1952, at Watlington Cottage Hospital, Watlington, Oxon, to May Myles (*née* Kebel Smith), wife of W. S. Gray, M.R.C.V.S., a brother for Iain.

Lewis.—On November 13th, 1952, at 24, Vincent Avenue, Stratford-on-Avon, to Judy and Michael Lewis, M.R.C.V.S., a sister for Kevin and Sue.

Moody.—On November 7th, 1952, to Honor and Frank C. Moody, B.SC., M.R.C.V.S., 6, Meadow Hill Crescent, Redditch, a second son.

Pitman.—On November 20th, 1952, at Priory Hospital, Haverfordwest, to Mary, wife of Kenneth Pitman, M.R.C.V.S., a daughter—Anne Louise.

Pronger.—On November 12th, 1952, to Marjorie (M.R.C.V.S.), wife of the Rev. K. D. Pronger, of White Hall, Duncans, Jamaica, B.W.I., a daughter—Gillian Mary.

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Ministry of Agriculture Veterinary Staff.—The following changes are announced:—

New Appointment: Cowie, J F., V.O. Nottingham, as from November 24th, 1952.

Resignation: Hart, A. W., V.O. Exeter. Resigns November 27th, 1952.

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R.V.C. Council.—Dr. Joseph Edwards, Chief of the Production Division of the Milk Marketing Board, has been nominated by the Privy Council to serve on the Council of the Royal Veterinary College and Hospital. The position carries with it *ex-officio* membership of the Court of Governors.

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R.C.V.S. OBITUARY

Shah, Sayed Iqbal Ali, M.R.C.V.S., Professor, Punjab Veterinary College, Lahore, West Punjab, Pakistan. Graduated London, December 20th, 1927. Died August 8th, 1951; aged 49 years.

Professor S. I. A. Shah, M.R.C.V.S.

Information has just reached us, to our deep regret, of the death, which occurred suddenly in August last from coronary thrombosis, of Professor Sayed Iqbal Shah, M.R.C.V.S., who had a distinguished and useful career in the veterinary services and colleges of India and Pakistan.

The son of Syed Mehtab Shah, Professor of Anatomy at the Punjab Veterinary College, Lahore, he qualified from the London College in December, 1927, joining the Veterinary Service in India in March of the following year. For about four years he was on special duty in the office of the Director of Animal Husbandry, Punjab, and Assistant Superintendent in that department. Two years followed as Superintendent (now designated Director) of the Animal Health Division, North-West Frontier Province and a similar period as Assistant Superintendent, Government Cattle Farm, Hissar, of which he became Superintendent after an interval of eight years as Superintendent of the A.H.D. in the Multan and Punjab Divisions. At various times, for a total period of three years, he occupied the position of Professor (Pathology, Anatomy) and Hospital Surgeon in the Punjab Veterinary College, Lahore, officiating as Principal of the College for a short period.

Professor Shah published a number of articles on Dhanni and Rojhan cattle and on the Dera Din Panah breed of goats, all indigenous to the Punjab.

We extend our sympathy to the widow, three boys and two daughters. His elder brother, Mr. S. M. A. Shah, M.R.C.V.S., is Director of Animal Husbandry, Punjab.

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THE LATE DR. J. T. EDWARDS

Further Personal Tributes

The Association for the Study of Animal Behaviour has lost a valued member and former councilman in Dr. J. T. Edwards, who regarded this subject as of paramount importance to veterinary science. As those who knew him closely will appreciate, his interest was by no means confined to the veterinary aspects, and in discussion with him it became clear that his width of reading throughout the whole field of ethology rivalled that of research workers in the subject. In his year as President of the Comparative Section of the Royal Society of Medicine he so planned the series of programmes that they culminated in one that was devoted to comparative psychology and animal behaviour. His recommendations relating to revision of veterinary curricula always contained provision for behaviour studies, and he it was who made the constructive suggestion and who, together with James Fisher, undertook the delicate negotiations that led to the contract with Messrs. Baillière, Tindall & Cox whereby a new quarterly periodical, the *British Journal of Animal Behaviour*, was founded. It is regrettable that, at the time of his death, the first issue, although it had reached the page-proof stage, was not actually published.

The interest displayed by Edwards in animal behaviour enabled him at one time to give practical expression to his extreme generosity of nature. He befriended Loeser, a worker in this subject who was a refugee, and shared house and home with him until the latter's death.

Edwards was, of course, deeply interested in history, and was always proud of the inscription that Campbell, the American veterinarian, had written to him in a presentation copy of his relevant textbook: "To the leading veterinary historian of our times." In animal behaviour, as in other subjects, Edwards delved deeply into the historical aspects and traced a pattern of development that has been accepted by behaviourists.

It behoves those of us who are engaged in the study of animal behaviour, or in the production of the new journal that owes its inception to Edwards, to demonstrate that the subject is indeed of profound importance to veterinary science and livestock husbandry and to prove that, to borrow John Hammond's words, it will have "a great influence in making a science of what is now known as the stockman's art." Nothing would have given "J. T." greater pleasure than to know that animal behaviour studies, the most absorbing interest of his later years, were being actively pursued by younger members of the veterinary profession.

A. N. W.

Mr. A. A. Mackay, of Orchard Cottage, Woodcote, Reading, writes: It came as a very great shock to my wife and me to learn from the *Record* last week of the sudden death of our very old and dear friend, Dr. J. T. Edwards.

By daily association with him at the R.V.C. from the date of his graduation in 1911, when he was appointed an assistant in the pathological laboratory at the R.V.C. where about half a dozen of us worked side by side, through the years, except for the break from 1914 to 1916, to the date he left for India, I can state that an unkind word never passed his lips. He possessed the most lovable disposition and his generosity knew no bounds, as many of his associates of those days will testify: many a time he would temporarily "beggar himself" to help a friend from "popping his mike." I was with him all through his period of editing the *Tropical Veterinary Bulletin*, and when he put in so many hours at Buckingham Palace Road on the *Record* to get copy away to Birmingham. As some of your correspondents have testified, he never spared himself in helping others, and going back to his early College days when temperatures of animals under experiment had to be taken at 9 p.m. and 12 p.m. it was Edwards who did four nights out of five, instead of one as it should have been.

Many abler than I will testify to his professional ability, but as long ago as 1913 the late Sir John M'Fadyean expressed the opinion that J. T. Edwards was one of the most promising research workers he had found, and he was not given to extravagance in speech.

Through all the years we have corresponded, and just before his illness had arranged for an evening together in town. I could fill

many pages testifying to his charm, his eagerness to help the "lame dog over a stile," his boundless generosity. He was a most lovable companion, and although our meetings during the past 15 years have been few and far between, we feel the loss of J. T. very deeply.

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CENTENARY ISSUE OF "THE FIELD"

Readers of this journal will recall that it was during the editorship of Sir Theodore Cook that *The Field* organised a campaign for funds for research which ultimately produced the Laidlaw-Dunkin method of immunising dogs against distemper. They will wish to participate the more fully, therefore, in congratulating that periodical upon the attainment of its centenary. In the centenary number just published are printed messages of congratulation from the Queen, Queen Elizabeth the Queen Mother, the Duke of Gloucester, and Mr. Churchill. The paper first appeared on January 1st, 1853, as the result of a suggestion made by Surtees, the creator of Mr. Jorrocks, and it was originally published by the proprietors of *Punch*. In addition to Sir Theodore Cook its editors have included Mark Lemon and Mr. Eric Parker.

The rules of lawn tennis were framed through the good offices of *The Field*. Early dog shows and field trials and the modern breech-loading shot gun were developments in which the paper played a part. It has been influential in promoting legislation to prevent cruelty to animals, including the docking of horses, the poaching of red deer, and the caging of wild birds.

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It is stated by the Australian Department of Health that British cattle and goats can again be imported into Australia. They have been barred since May because of foot-and-mouth disease in Britain. Channel Islands cattle and goats will not be admitted, as the disease is still prevalent in France. An official said that British sheep (barred since March) and pigs (barred since May) would not be admitted, because scrapie—a virus disease affecting the skins and wool of sheep—and swine fever were still prevalent in Britain.

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LEGAL NOTES

Illegal Practice: Another Successful R.C.V.S. Prosecution

In its issue of November 7th, the *Kent Messenger* records that Leslie Henry Hart, 42, of 3, Fulling Mill House, Square Hill Road, Maidstone, was fined a total of £10 with £3 14s. costs at Malling Court.

He pleaded guilty to two offences of practising veterinary treatment on a dog at Mereworth when he was not a registered veterinary surgeon or on the supplementary veterinary register.

A third summons alleged that Hart applied the description "Hartois Dispensary, Canine Specialist" to a business carried on by him, which was calculated to lead to the belief that he was a veterinary surgeon.

Mr. A. E. Graves (defending) contended this was outside the jurisdiction of the court as the allegation took place in the borough of Maidstone, and Mr. D. R. Rooke, prosecuting for the Royal College of Veterinary Surgeons, agreed. The summons was withdrawn.

Describing the proceedings as "rather unusual," Mr. Rooke said the object of the relevant Act was to regulate the profession and also to protect animals.

Hart had applied to be put on the supplementary list, but his application arrived too late—it had to be within 12 months of the coming into force of the Act—and the Council of the Royal College of Veterinary Surgeons would not allow the late application.

The proceedings arose as Hart treated a dog belonging to Mr. and Mrs. G. W. Davey, of The Bungalow, Beech Hill, Mereworth. Hart gave the animal injections and tablets.

Mrs. Alice Bessie Davey said she thought Hart was "a proper vet." She paid him 18s. 6d. and £1 0s. 3d. for the treatment he gave to the dogs.

Mr. Graves said Hart had loved animals since a boy and he had made treatment to cats and dogs his life-long work. He treated no other animals except cats and dogs and never attempted any surgery. Defendant was well sought after by people who knew his abilities, and there was no question that he was very good with his treatment of cats and dogs.

Colonel J. Sterndale Bennett (Chairman) told Hart that although he knew he was not qualified, he took on the responsibility of treating the dog.

"This cannot be tolerated and we have to protect the public," he declared.

Veterinary Director in Germany

Brigadier A. G. Heveningham, the Director of the Army Veterinary and Remount Services, recently visited Rhine Army. He saw R.A.V.C. installations in Bad Oeynhausen, Berlin and Sennelager.

Accompanied on his eight-day tour by Lieut.-Colonel L. W. Coulden, head of Rhine Army's Veterinary Services, Brigadier Heveningham paid two visits to the Army Guard Dog School in Sennelager where he saw war dogs being trained, and met "Polo"—a retired war veteran. Originally an Infantry patrol dog, he landed with paratroops in North Africa where he was wounded. Recovering from his wounds, he later saw service in Italy.

Brigadier Heveningham is seen here in conversation with Lieut.-Colonel L. W. Coulden (centre) and Captain G. Hamilton-Dick, Second-in-Command of the unit at Sennelager (left).

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ADDRESSES OF DISEASE-INFECTED PREMISES

The list given below indicates, first, the county in which are situated the premises on which disease has been confirmed, followed by the postal address and date of outbreak.

ANTHRAX:

Berks.—Keep Hatch Farm, Wokingham (Nov. 15th).

Ches.—Fields Farm, Sandbach; Lily Farm, Byley, Middlewich (Nov. 14th); The Firs, Oldcastle, Malpas (Nov. 17th); Chesworth Farm, Bradwell, Sandbach (Nov. 19th).

Cornwall.—The Homestead, Penstraze, Chasewater, Truro (Nov. 18th).

Devons.—Denes, Landkey, Barnstaple (Nov. 19th).

Glos.—Kington Mead Farm, Thornbury (Nov. 17th); Stibbs Close, Back Lane, Marshfield, Chippenham (Nov. 20th); Ewes Pens, Long Lane, Frampton Mansell, Stroud (Nov. 21st).

Hants.—Ford Farm, Denford, Kettering (Nov. 18th).

Herts.—Amwell Farm, Amwell, Wheathampstead, St. Albans (Nov. 18th).

Lancs.—Helms Farm, Garstang Road, Barton, Preston (Nov. 14th); Billingtone Farm, Barton, Preston; Lightfoot House Farm, Fullwood, Preston (Nov. 17th); Higher Trapp Farm, Simonstone, nr. Burnley; Lower Lingart Farm, Barnacre, Garstang (Nov. 18th); Foulbrick Farm, Hambleton, Blackpool; Brick House Farm, Chipping, Preston (Nov. 28th).

Leics.—Hill Top Lodge Farm, North Kilworth, Rugby (Nov. 15th).

Norfolk.—Hawthorne Farm, Tharston, Norwich (Nov. 15th); Manor Farm, Martham, Great Yarmouth (Nov. 18th); Goose Pie Farm, Cawston, Norwich (Nov. 19th); Church Farm, Great Witchingham; Smallholding, Framington Pigot, Norwich (Nov. 20th).

Notts.—Field Farm, Rolleston, Newark (Nov. 15th); Grange Farm, Balderton, Newark (Nov. 18th).

Salop.—The Village Farm, Crackley Bank, Sheriffhales, Shifnal (Nov. 20th).

Somerset.—Escott Farm, Withycombe, Watchet (Nov. 14th); Bennett's Hill Farm, Holcombe, Bath (Nov. 15th); Lower Westholme, Pitton, Shepton Mallet; North Town Farm, North Cadbury, Yeovil (Nov. 17th); Moorsick Farm, Buckland St. Mary, Chard (Nov. 18th); Strodes Arm, Cranmore, Shepton Mallet (Nov. 20th).

Suffolk.—Red House Farm, Elmsett, Ipswich (Nov. 15th); Manor Farm, Herringfleet, Lowestoft (Nov. 17th); Beecrofts Farm, Warlingforth, Woodbridge (Nov. 19th)

Sussex.—Coldharbour, Sutton, Pulborough (Nov. 18th); Woolpack Farm, Nutley, Uckfield (Nov. 19th).

Wilts.—Small Holding, Sewage Works, Mere (Nov. 14th); Ridge Farm, Stert, Devizes (Nov. 15th); Yews Farm, Odstock, Salisbury (Nov. 19th).

Worcs.—Oldfield Inn, Oldfield, Ombersley, Droitwich (Nov. 19th).

Yorks.—Ashes Farm, Caldbergh, Leyburn (Nov. 14th); Briscoe Farm, Baldersdale, Cotherstone, Barnard Castle (Nov. 15th); Old Hall Farm, Thoralby, West Burton, Leyburn (Nov. 18th); Cape Farm, Sherriff Hutton, York (Nov. 20th); Grange Farm, Gerrick, Moorsholm, Saltburn; Manor Farm, Brayton, Selby (Nov. 21st).

Fowl Pest:

Cambs.—21, Benwick Road, Doddington, March (Nov. 15th); 17, Wimblington Road, Doddington (Nov. 19th).

Derbys.—Cedar Farm, Tibshelf, Derby (Nov. 20th).

Essex.—Lake View, Mill Street, St. Osyth, Clacton-on-Sea (Nov. 14th).

Herts.—Mont-au-Source, Loudwater, Rickmansworth (Nov. 19th).

Kent.—Iron Mill Bungalow, Upper Ruvely Farm, Sidcup (Nov. 20th).

Sussex.—Paygate Bungalow, Hartfield, Tunbridge Wells, (Nov. 17th); 3, Gloucester Cottages, Brighton (Nov. 18th); Audiburn Farm, Kingston, Lewes; Little Bassett's Farm, Hartfield, Tunbridge Wells (Nov. 20th).

Warwicks.—The Glebe Farm, Tamworth in Arden, Birmingham (Nov. 18th).

Swine Fever:

Denbighs.—Garnedd Ucha, Peniel, Denbigh (Nov. 17th).

Essex.—Copford Green Farm, Copford, Colchester (Nov. 17th); The Grove, Maldon Road, Great Totham, Maldon; 179, High Street, Hornchurch, Romford (Nov. 19th).

Lincs.—Bleak House, Wingland, Sutton Bridge, Holbeach (Nov. 14th); Rotten Row, Theddlethorpe, St. Helens, Mablethorpe (Nov. 19th).

Staffs.—2, Victoria Street, Burton-on-Trent (Nov. 18th).

Suffolk.—Bullock Lodge Farm, Risby, Bury St. Edmunds (Nov. 18th); Nether Hall, Harkstead, Ipswich; Ivy Cottage, Great Henny, Sudbury (Nov. 21st).

Wigtowns.—No. 1, Kilfillan Small Holdings, Glenhue, Newton Stewart (Nov. 17th).

Worcs.—Sunnyside, Drakes Broughton, Pershore (Nov. 18th); 167, Walkwood Road, Hunt End, Redditch (Nov. 20th).

CORRESPONDENCE

The views expressed in letters addressed to the Editor represent the personal opinions of the writer only and their publication does not imply endorsement by the B.V.A.

INJURIES TO THE STIFLE JOINT IN YOUNG GREYHOUNDS

Another Trap for the Unwary

Sir,—I agree wholeheartedly with Mr. N. R. Turnbull (*The Veterinary Record*, No. 46, Vol. 64) that young dogs frequently injure their stifle joints. It is a remarkable fact, however, that in the young greyhound nearly all such injuries involve bony structures and most commonly the tibial crest. It is well known that these valuable youngsters must have almost unlimited exercise and freedom if they are to be well reared and speedy on maturity. Puppies are turned out at an early age on ground which they get to know, and they eventually take terrific risks in their frolics but, strange to say, they seem to have such judgment and quickness of eye that uneven surfaces and known ground hazards seldom cause trouble other than an occasional damaged toe. Sprains of muscles and of joints, as are experienced in the adult, are practically unknown.

The stifle is far and away the most vulnerable joint, and injury to this is almost invariably trauma. Puppies in a fenced area may be chasing something on the other side of the fence and collide at speed with one of the fence posts. The stifle takes the blow, seldom the shoulder. A puppy may be galloping across a field and hit a tree or post in trying to short-circuit a fellow or a rabbit, again he hits the stifle. But one of the most common sources of injury is the gate or doorway. A litter of puppies will barge through an opening at speed and one will hit the gatepost or door post. Again it is the stifle which suffers.

My experience of such cases is that the separately ossifying tibial crest is moved in an upward direction from the main bone. Lameness is severe, but pain is not very severe on palpation. The leg is not held flexed, but hangs just off the ground. No weight is taken on it. Recovery takes place with little or no treatment if the puppy is isolated from his fellows and exercise limited to a small paddock. It takes three months and sometimes longer. There is quite palpable swelling and permanent discernible thickening. The upward fragment of the tibial crest gets drawn down or absorbed into the adult crest and the dog usually completely recovers to race. There are three such cases racing on London tracks at present and I have a younger bitch in the earlier state on these premises.

Whilst I agree, therefore, with Mr. Turnbull on the necessity of using X-rays for diagnosis and being well acquainted with the normal appearance of the young bone, on a radiograph, my experience in so far as the young greyhound is concerned, does not lead me to agree that the majority of stifle injuries in them are merely severe sprains. I might even go further and warn any of our colleagues in greyhound practice to suspect fracture or dislocation of the tibial crest in any sapling which has swelling over the stifle area and is carrying the leg. The suspicion should be confirmed or otherwise by X-ray. To illustrate my point I attach radiographs of three different puppies all of which went on to race. [See art plate facing page 767.—*Editor.*]

The additional trap for the unwary, then, lies in the danger of mistaking the traumatically moved and as yet unossified tibial crest for the normal one. Diagnosis easily can be confirmed by comparing a radiograph of the other leg. Strangely enough, whilst the above is the usual type of injury in the young greyhound stifle, it is completely different from the traumatic adult stifle, where the injury occurs elsewhere.—Yours faithfully, Jas. K. Bateman, The Hook, Northaw, Potters Bar, Middlesex. *November 17th, 1952.*

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TREATMENT OF PREGNANCY TOXAEMIA IN EWES

Sir,—The clinical communication entitled "Treatment of Pregnancy Toxaemia in Ewes by Oral Administration of Glycerol" by Mr. Wyn R. Griffiths, F.R.C.V.S., in last week's issue of *The Veterinary Record* is deserving of the fullest consideration by practitioners and research workers interested in this disease. If the successful results obtained by Mr. Griffiths can be repeated by other practitioners following his line of therapy then, indeed, a great advance will have been made in the treatment of this hitherto fatal disease; and another milestone passed on the road of progress in the treatment and prevention of diseases of sheep, in which so many advances have been made by the veterinary profession over the past 25 years.—Yours faithfully, J. F. Timoney, Veterinary Research Laboratory, Dublin. *November 18th, 1952.*

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PARALYSIS IN SIAMESE CATS

Sir,—I have recently seen three cases of a rather unusual nature in Siamese cats, bred in this country from English imported stock. Three kittens in one litter of seven developed a rapidly progressing paralysis in all four limbs at the age of three months. Two had been reared by the breeder, but the third had been sold as a young kitten, and therefore reared under different conditions. The sire of these kittens has been used extensively, and has never produced any abnormality. The mother is from English stock, and this was her first litter. I am interested to know if symptoms of this kind have been seen among Siamese cats in England.—Yours faithfully, Pamela M. Reynolds, 675, St. Clair Avenue West, Toronto 10, Ontario, Canada. *November 2nd, 1952.*

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"WARFARIN" POISONING IN THE DOG

Sir,—Further to my letter reporting a case of "Warfarin" poisoning. I should like to express my thanks to all those readers who have kindly written to me giving valuable information and references.—Yours faithfully, W. M. Taylor, 14, Station Road, Crawley, Sussex. *November 22nd, 1952.*

Advertiser's Announcement

Baillière, Tindall & Cox: Veterinary Books and Periodicals

Many of your readers may be glad to have the new edition of our catalogue "Veterinary Books," which will help them to keep abreast of current literature in the field of veterinary medicine. The catalogue lists the veterinary books of all publishers, and is as complete as we have been able to make it; most of the books listed are available from stock, whilst those that are not can usually be obtained within a few days. A copy gladly will be sent on application to us at 7 and 8, Henrietta Street, Covent Garden, London, W.C.2.